54 DRILLING
the OIL AND GAS JOURNAL

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...getting your well down in shortest possible time!

HUGHES research and the combined efforts of the HUGHES field organization* have *one purpose*... giving you bits that will get your well down in the least possible time... and at the least possible cost.

The HUGHES man responsible for servicing your rig knows from actual field experience the bits that will give you the fastest penetration and most footage in the formations you are likely to encounter. And you can depend on him to have the right bits on your rig at the right time.

* *A field organization of over 400 serves the industry in the United States and Canada*

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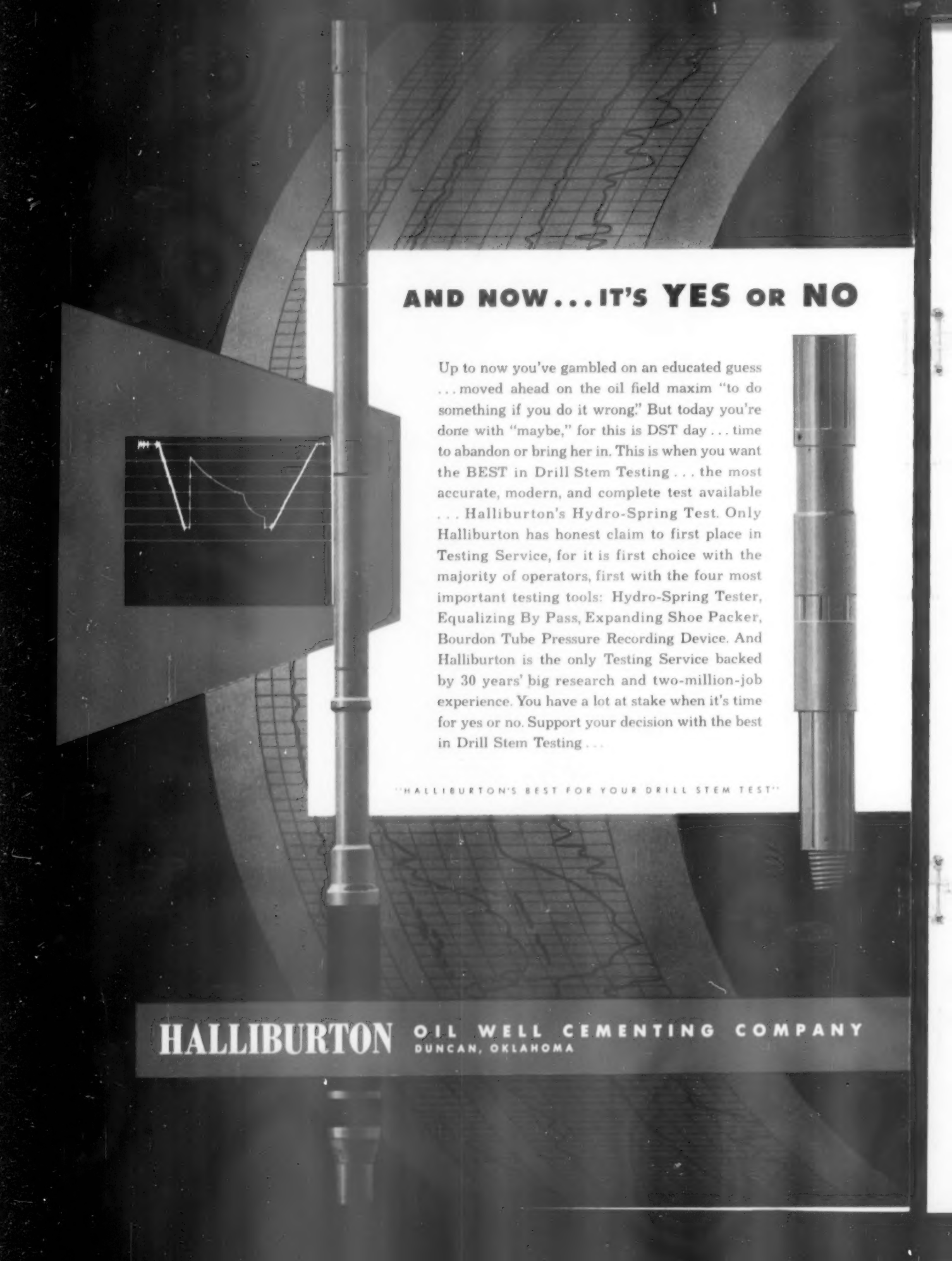

AND NOW... IT'S YES OR NO

Up to now you've gambled on an educated guess ... moved ahead on the oil field maxim "to do something if you do it wrong." But today you're done with "maybe," for this is DST day ... time to abandon or bring her in. This is when you want the BEST in Drill Stem Testing ... the most accurate, modern, and complete test available ... Halliburton's Hydro-Spring Test. Only Halliburton has honest claim to first place in Testing Service, for it is first choice with the majority of operators, first with the four most important testing tools: Hydro-Spring Tester, Equalizing By Pass, Expanding Shoe Packer, Bourdon Tube Pressure Recording Device. And Halliburton is the only Testing Service backed by 30 years' big research and two-million-job experience. You have a lot at stake when it's time for yes or no. Support your decision with the best in Drill Stem Testing ...

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DUNCAN, OKLAHOMA

the OIL AND GAS JOURNAL

OCTOBER 11, 1954 VOL. 53 NO. 23

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In Brief . . .

The Journal's annual drilling contractors' issue contains three sections:

• TOOL PUSHER'S REFERENCE . . . Here are eight operational articles which point up good drilling practices and show methods of reducing costs. These articles cover directional drilling, completion fluids, drill-collar care, hardfacing of tool joints, fishing, slim-hole drilling, drain-hole drilling, and a field report of reduced drilling times.

DRILL-COLLAR CARE includes control of makeup, rotary speed, and proper choice of design and of material.

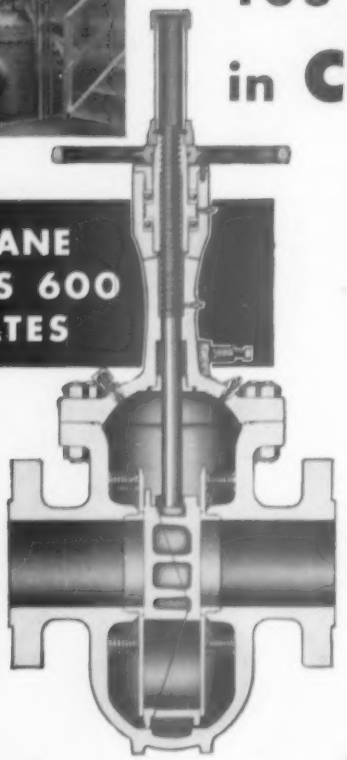
MUD CENTRIFUGE, tested by the Phillips Petroleum Co., has enabled the economical maintenance of a low-solids, weighted mud.

HARDFACING OF TOOL JOINTS done with portable, automatic, electric machine welding shows advantages in closer control, faster and more uniform application, and minimum heat penetration.

• ACTIVE AREAS . . . Here is a round-up of drilling activities of the major oil-producing provinces in the United States and Canada—where hole is being made, what the drilling problems are, and what the outlook is. Present drilling trends indicate that 1954 will be a record year.

• DRILLING REPORTS . . . Contractors and oil companies will find that these drilling reports are a useful guide for their operations in a given field. The Journal presents a detailed survey of drilling practices in 71 active and representative fields in the United States and Canada.

You get long-run quality in CRANE pipeline valves



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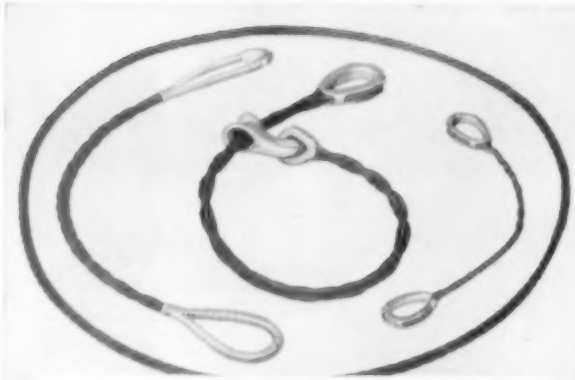

Braided Wire Rope Slings

Materials handling—from unloading a car of pipe to handling a 200-ton generator—requires a wide variety of safe, economical, easy-to-handle slings. The sizes and types of Macwhyte Slings are practically unlimited—they are available in many standard designs or can be custom-made. Bulletin lists and illustrates many types and body styles in Round-Braided, Flat-Braided and Single- Part Slings. *Specify Bulletin 5308.*

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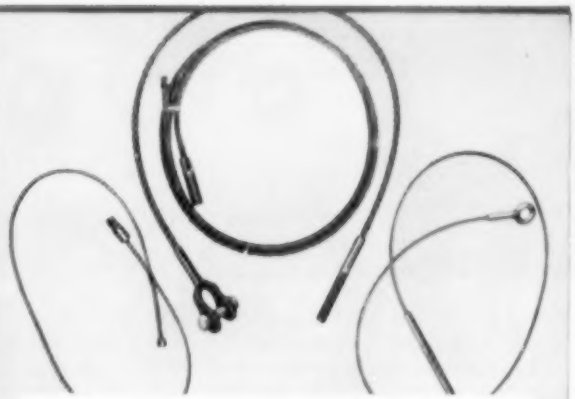

Wire Rope Assemblies

Safe-Lock Wire Rope Assemblies provide a unit of wire rope with permanently attached fittings made to specified size, length, and strength needed. A wide selection of fittings and wire rope are made for use on small gasoline powered equipment; outboard motors; mining and excavating machines; agricultural implements; automotive, aircraft, marine, and laboratory equipment. *Ask for Catalog 5201.*

Recommendations for the correct wire rope product for your needs will be gladly furnished.

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It has a rated input of 925 hp, yet weighs only 46,200 lbs.—less than 50 pounds per horsepower.

The power end is of advanced design, with side opening for inserting the gear assembly. This type construction eliminates bearing caps and large rear cover openings, permitting a rigid tie between bearing supports and resulting in strong overall support for all working parts.

The large-diameter crankshaft is mounted in tapered-roller bearings which are spaced extremely wide so that the relation between bearing spread and the overhang of the crank centers is far more favorable than in pumps of conventional construction.

This increased input horsepower, converted into greater mud pressure at the bit, enables operators to make fewer liner-size changes even when drilling to maximum depths.

WOULD . . . *increased mud pressure enable you to drill faster with your present rig? If so, it will pay you to investigate "Oilwell's" No. 818-P!*

A Quick Look at its PRESSURE-CAPACITY Range

Piston Size Inches	Maximum Working Pressure psi	Gallons Per Rev.	Displacement (Piston Rod Deducted) GPM at Pump Speed RPM of:				
			30	40	50	60	65
6	2750	7.52	225	300	375	450	490
6½	2290	9.05	270	360	450	540	585
6¾	2100	9.86	295	395	490	590	640
7	1940	10.70	320	425	535	640	695
7¼	1790	11.57	345	460	580	695	750
7¾	1550	13.42	400	535	670	805	870
8	1440	14.38	430	575	720	860	930
BHP Required			425	570	710	855	925

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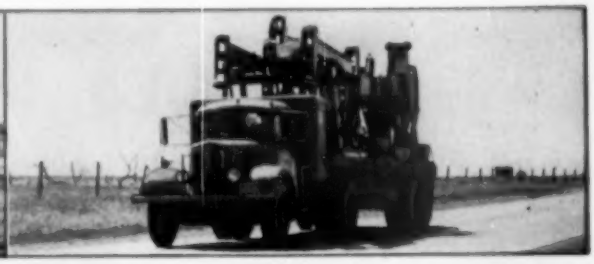
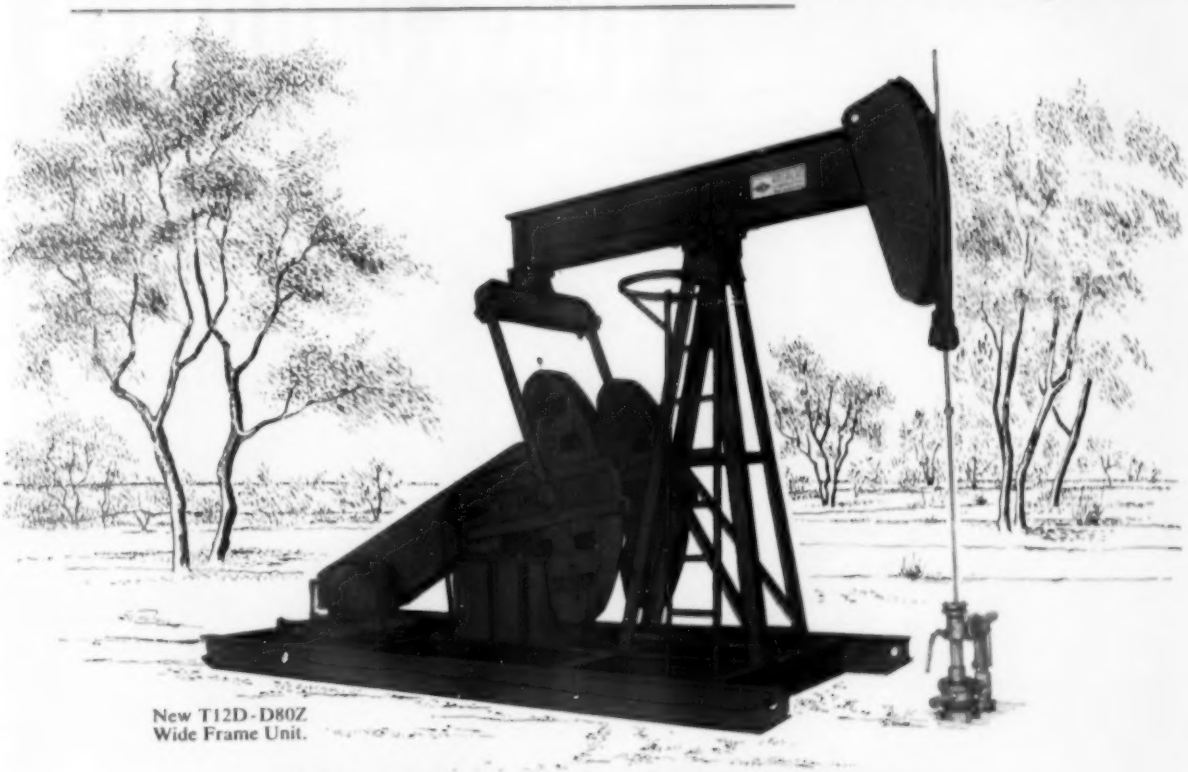


From Delivery Date Through



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Wide Frame Unit.

Years of Service

American Gives You MORE

Your American Pumping Unit is delivered right *when* you want it—right *where* you want it . . . at well site on your lease. This factory-to-lease safe delivery of your unit is standard American policy and is included in your zone price on all units ordered in truck load quantities.

AMERICAN FOLLOWS UP!

American service does not stop with delivery. American maintains a complete service record on all units. Trained field men periodically check American Pumping Units in the field—offer suggestions on maintenance—show you how to get even longer wear, more satisfactory service, and low-cost pumping from your unit. These same field men are also available to give prompt service in case of an emergency.

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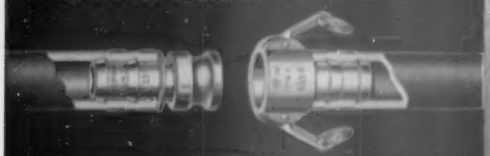
MARINE SERVICE

Make field repairs quickly with this simple attachment of hose to KAMLOK shank type adaptor and coupler by using hose clamps. Leak-proof, light weight, easy to handle.

ALL KAMLOKS COUPLE AND UNCOUPLE INSTANTLY REGARDLESS OF HOOK-UP.



KAMLOK'S POSITIVE SEAL-ALL ALONG THE LINE ASSURES GREATER SAFETY IN HANDLING ALL TYPES OF LIQUIDS.

Excellent hose has been condemned too often because of inferior couplings. To eliminate twisting, kinking, and straining, to add extra life and endurance to your hose use a good coupler . . . use KAMLOKS. Available in any combination to meet coupling requirements in sizes from ¾" to 3" precision machined of special hard wear resistant bronze. 4" size of OPALUMIN.*

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WITH THE BEST
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The wildcat shows its spots when the testing string is back on the walk. It's much easier to decide correctly with Halliburton's Hydro-Spring Test... the most accurate, modern, and complete formation test available.

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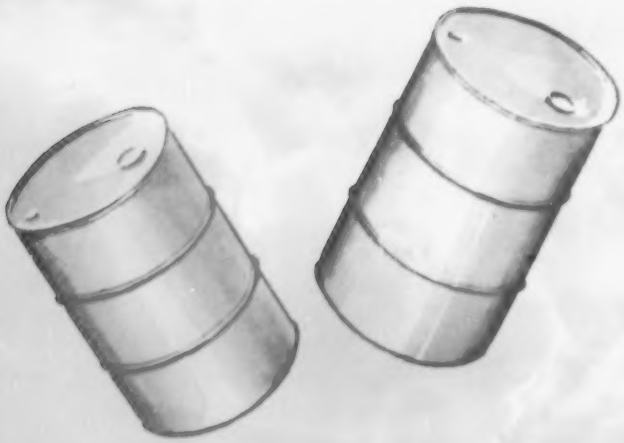
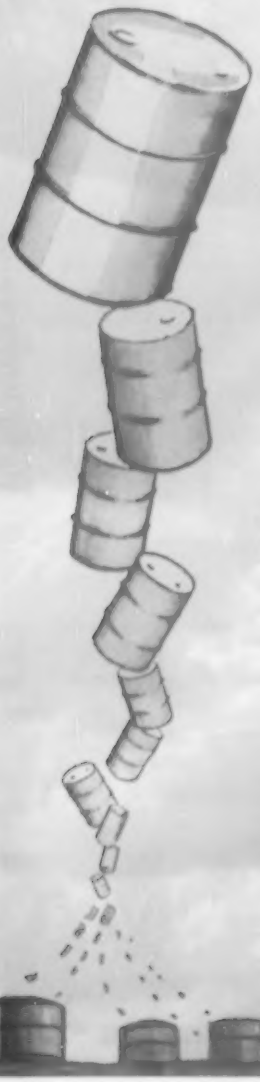


Save 90% of the oil normally lost to evaporation



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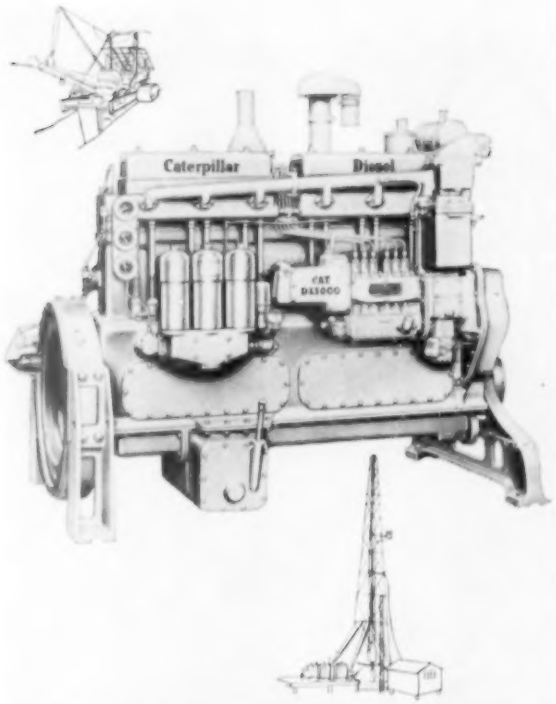

Announcing the

NEW 190-HP CAT* DIESEL ENGINE

CATERPILLAR ADVANCED DESIGN FEATURES IN THE NEW D13000

While retaining such time-proved features as aluminum alloy main and connecting rod bearings, "Hi-Electro" hardened and Superfinished bearing surfaces, exclusive Caterpillar fuel injection system, ability to use low-cost No. 2 furnace oil without fouling, etc., the new D13000 incorporates many new features, among them:

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For complete details, specifications, attachments, etc., see your nearby Caterpillar Dealer

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In the new D13000, you get 21% more brake horsepower. Its governed speed, raised to 1200 r.p.m., provides greater versatility and productive capacity. While keeping outstanding, time-tested parts, it adds advanced design features to set new standards of stamina, dependability, economy and long life. And its wide variety of matched accessories and attachments makes it readily adaptable for any need.

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OF OIL FIELD POWER

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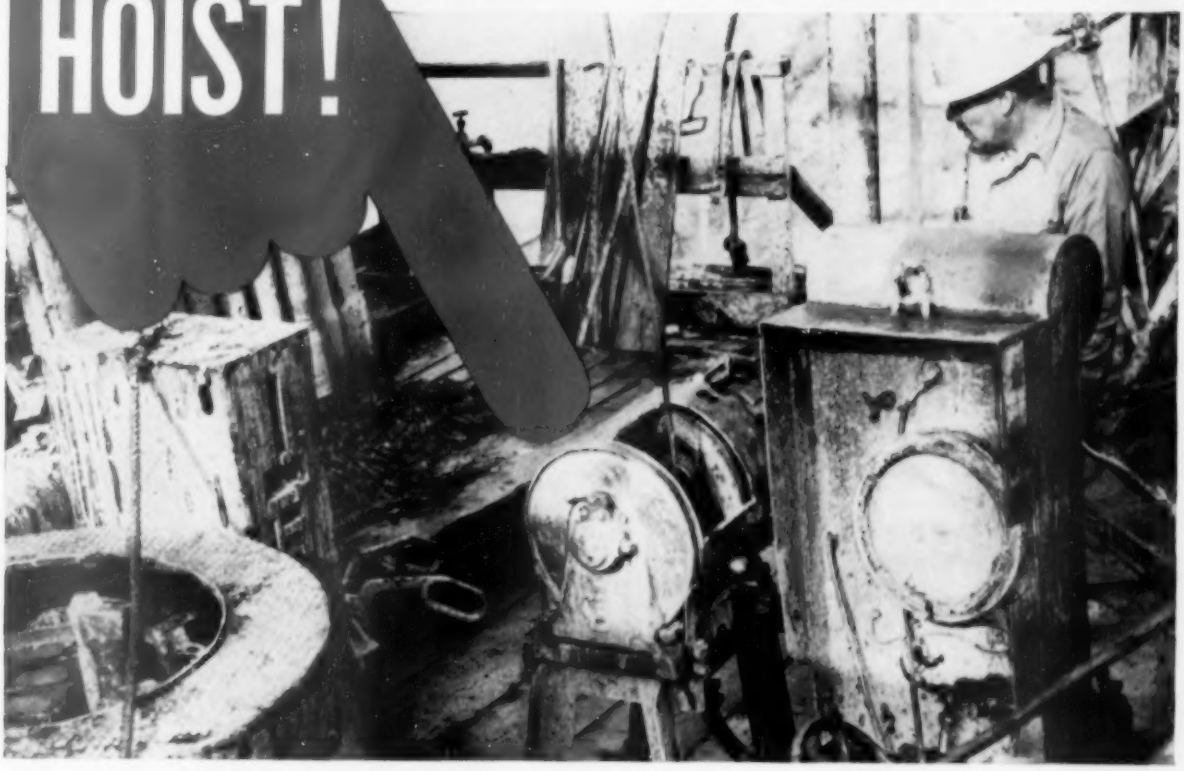
AIR HOIST!

...ONE OF FOURTEEN

GARDNER-DENVER ITEMS USED ON A MODERN RIG



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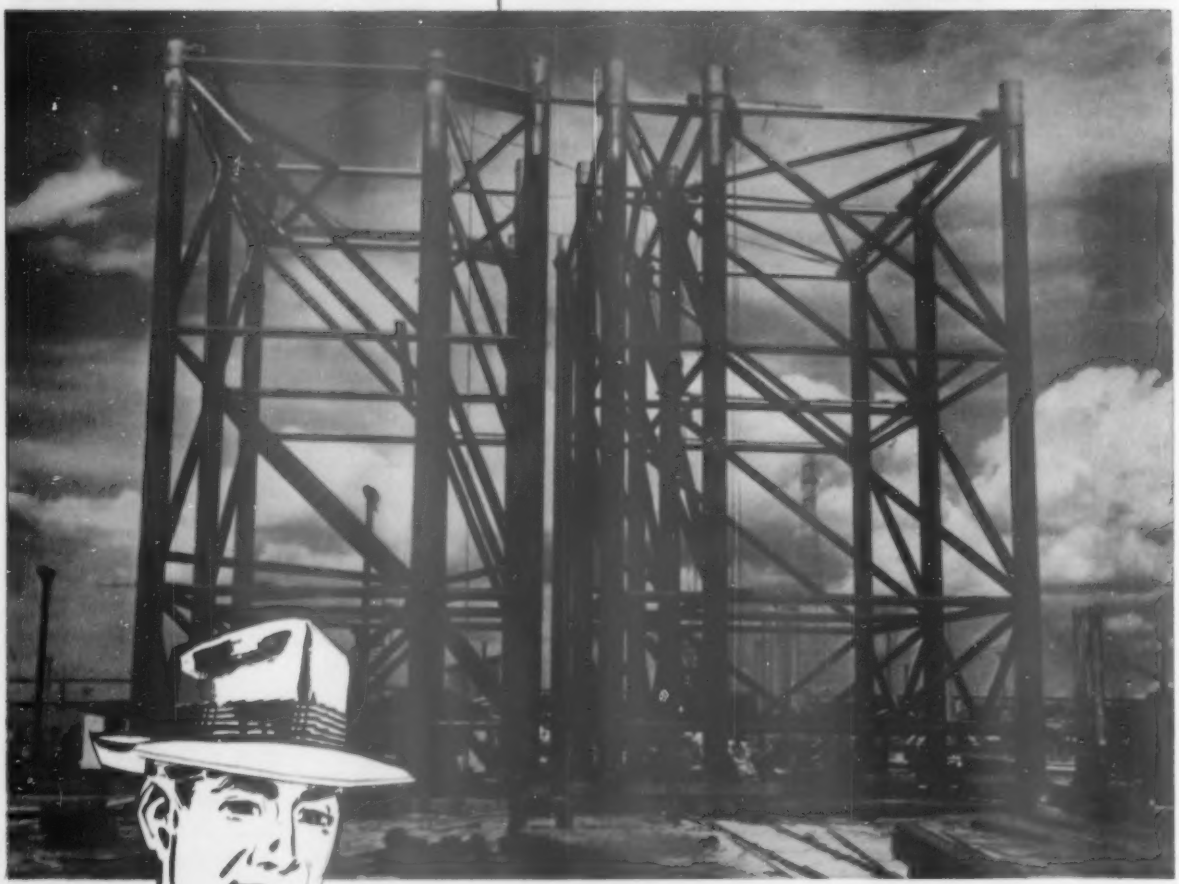
no job is too BIG for AVONDALE



60′ Section of CALCO Pipe Jacket built by Avondale. In the background to the right, fabrication of superstructure.

The business of offshore drilling is a BIG business,requiring BIG equipment. The Petroleum Industry needs Drill Barges, Derrick Barges, Pile Driver Barges, Pipe Jacket and Platform Structures—all built to the highest standards of quality and performance. Avondale knows how to give the Oil Industry what it wants and needs in the way of construction, repair and fabrication. Their fame is well known . . . their Integrity and "know-how" unchallenged.

CONSULT AVONDALE ON YOUR NEXT JOB.

SHIP BUILDING · SHIP REPAIRING · FOUNDERS · PROPELLERS · STRUCTURAL STEEL

AVONDALE MARINE WAYS, INC. CABLE ADDRESS "AVONWAYS"

P. O. BOX 1030 • PHONE UNiversity 4561 • NEW ORLEANS 8, U. S. A.

4 MURPHY DIESELS

power California's first offshore drilling rig

● Now in operation 8,000 ft. offshore, west of Seal Beach, is the first tideland drilling operation off the California coast. Brown Marine Drilling Company, Long Beach, is the contractor, and put together the packaged rig that is being used. Four Murphy Diesel Fuel Engines are a key part of the rig. Three of the Murphys, each rated at 200 H.P. continuous, are on the floor compounded to power the table, drawworks and main pump. The fourth Murphy of the same size powers the standby pump.

On jobs like this and ashore, Murphy Diesel Power is proving itself to be an oilman's kind of power—responsive, dependable and economical. Ask your Murphy Diesel Dealer to show you what Murphy Diesel can do for you.

MURPHY DIESEL COMPANY

5305 W. Burnham St. Milwaukee 14, Wisconsin

Engines and power units 90 to 260 H.P.; dual-fuel engines, 135 to 215 H.P.; marine propulsion and auxiliaries, 90 to 225 H.P.; generator sets 60 to 154 K.W.

Photo courtesy Brown Marine Drilling Company

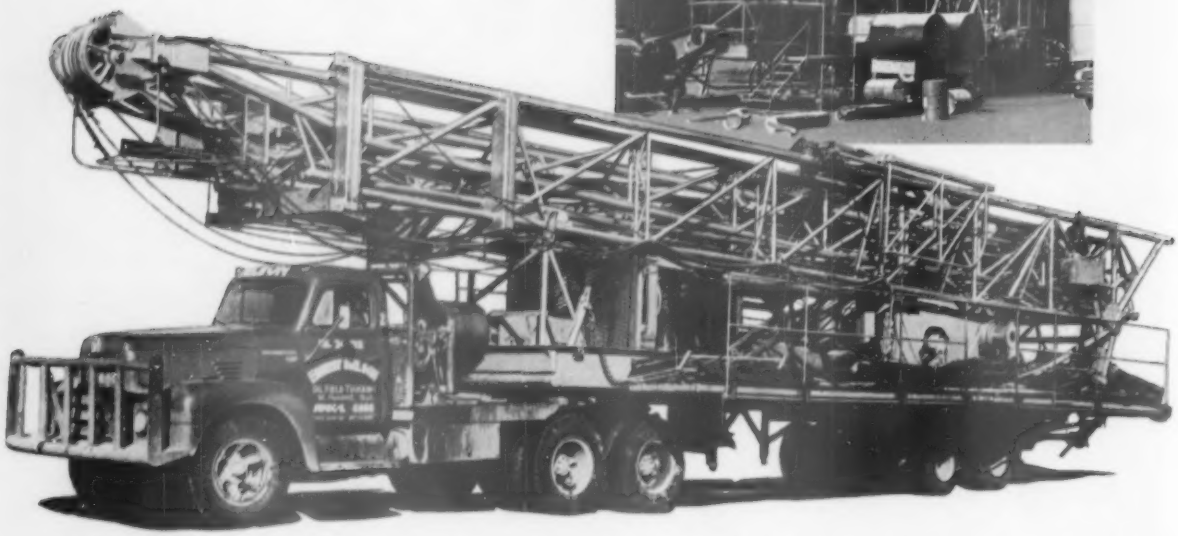
MURPHY DIESEL

SEE YOUR MURPHY DIESEL DEALER, TODAY—

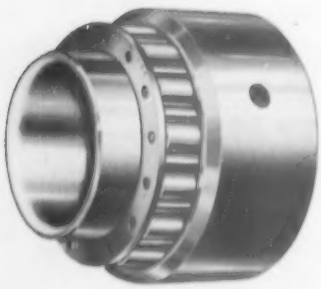
ALBUQUERQUE, NEW MEXICO, Lively Equipment Company; BUTTE, MONTANA, Hall-Perry Machinery Company; CORPUS CHRISTI, TEXAS, Houston Engine & Pump Company; DALLAS, TEXAS, Conley-Lott-Nichols Machinery Co.; DENVER, COLORADO, Power Equipment Company, EDMONTON, ALBERTA, CANADA, Northern Engine & Equipment Co., Ltd.; GREAT BEND, KANSAS, Manufacturers Dist. Co.; GREAT FALLS, MONTANA, Hall-Perry Machinery Company; HOUSTON, TEXAS, Houston Engine & Pump Co., Inc.; JACKSON, MICHIGAN, Utility & Industrial Supply Co.; LOS ANGELES, CALIFORNIA, Industrial Engine Service; LUBBOCK, TEXAS, Conley-Lott-Nichols Machinery Co.; SAN ANTONIO, TEXAS, The Roy Klossner Company; BAKERSFIELD, CALIFORNIA, Glenn Rose Engine Service; ODESSA, TEXAS, Conley-Lott-Nichols Machinery Co.; LONGVIEW, TEXAS, Nichols Machinery Co.
TULSA, OKLAHOMA, SALES, PARTS AND SERVICE.

304

Fastest moving rig in the field!



ONE OF MANY BUILT WITH HYATT BEARINGS



This monster, "Pioneer 52," produced by Franks Mfg. Corp., Tulsa, really gets the holes down in a hurry! Look at its specifications:

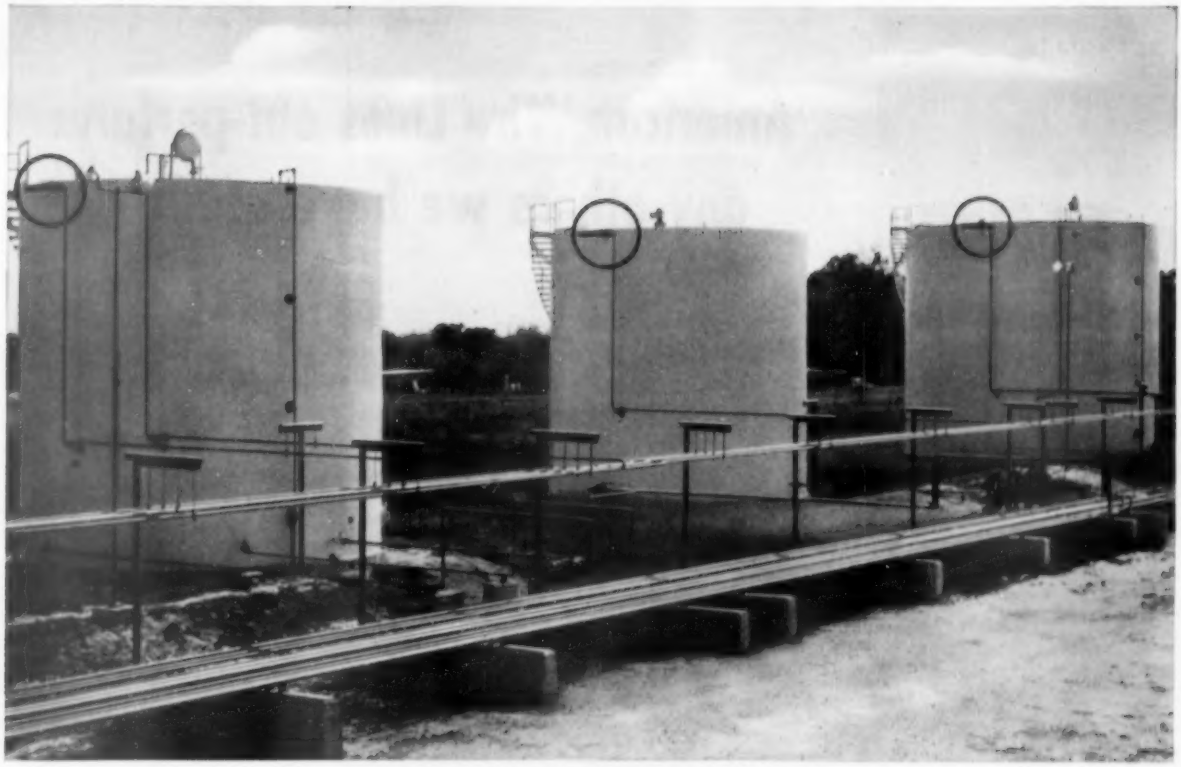
- 7,500-ft. trailer drilling rig
- 600 horsepower
- integrally mounted 102-ft., 250,000-lb.-capacity telescoping derrick with trailer substructure
- *HYATT Roller Bearings on all Franks drawworks drums* for smooth, dependable operation.

In fact, there are 4,000 HYATT-equipped drums in the field—because drillers know that *for holes in a hurry, you can't beat HYATTS!*

HYATT ROLLER BEARINGS

STRAIGHT BARREL TAPER

HYATT BEARINGS DIVISION • GENERAL MOTORS CORPORATION • HARRISON, NEW JERSEY



Rockwood Double Barrelled Foam Maker Chambers (circled) guard oil storage tanks in a southern refinery above.

The bubbles that keep oil safe

The tube-like objects circled in the photograph above have a special way of generating bubbles that safeguards the oil within the storage tanks.

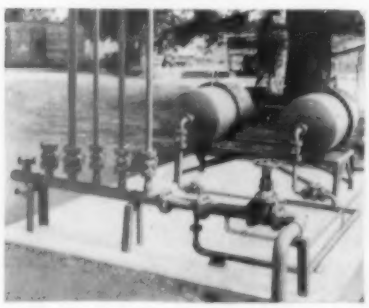
Should fire break out, these tubes — Rockwood Double Barrelled FOAM Maker Chambers — will swiftly pour a smothering FOAM blanket over the flames, controlling and extinguishing the fire. What's more, they pour a denser type of Rockwood FOAM blanket than ordinarily produced.

Inside each tube are two concentric barrels, one within the other. Internal impinging jets discharge into these barrels, dynamically mixing air, water and FOAM into a finer bubble structure than ordinarily possible and thus producing the extra-dense blanket that keeps oil safe.

This patented construction of Rockwood Double Barrelled FOAM Maker Chambers is typical of the careful way in which Rockwood engineers every detail of a Rockwood SpotPROTECTION System. These systems take the danger out of danger "spots", protect lives, property, money. Take advantage of them for your own protection.

ROCKWOOD SPRINKLER COMPANY

Engineers Water . . . to Cut Fire Losses



These Rockwood SpotPROTECTION Liquid Storage Tanks contain Rockwood FOAM. A balanced pressure proportioning system automatically proportions the FOAM into the water. This properly balanced mixture is then fed into the system that protects the tanks.

Rockwood Double Strength Foam clings to metal surfaces as an insulator — FOAM Liquid flows freely at sub-zero temperatures. Excellent for extinguishing fires in gasoline, benzol and other highly volatile liquids as well as ordinary combustibles.

SEND FOR THIS INFORMATIVE BOOKLET

ROCKWOOD SPRINKLER COMPANY
Portable Fire Protection Division
370 Harlow Street
Worcester 5, Mass.

Please send me your illustrated booklet on Rockwood fire-fighting products.

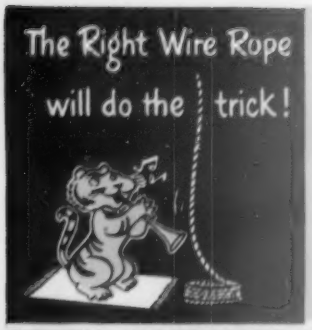
Name _____

Title _____

Company _____

Street _____ City _____

Zone _____ State _____



"American Wire Lines out-perform any others we have used."

That's Bruce Harp talking— West Texas Drilling Superintendent for Exploration Drilling Co. Here's what he says about American Tiger Brand Wire Lines: "We keep accurate ton-mile records and we know what each one of our lines has done. We've used almost every kind of wire rope there is, but I'll say that American Lines give us the best service of any."

American Tiger Brand Wire Lines give long service because they are especially designed for tough oil drilling service. Tiger Brand Rotary Drilling Lines and Cable Tool Drilling Lines, Sand Lines, Coring Lines, and Winch Ropes provide the strength and wear resistance for every type of drilling job you have. And the American Wire Rope Engineer in your area will be glad to help you choose the ones that will work best on your rig. Just get in touch with the nearest American Wire Line Distributor.

EXPLORATION DRILLING CO.'S Rig #16 is equipped with 8450 ft. of 1⅛" American Tiger Brand Drilling Line, which has an Independent Wire Rope Core and is preformed for better spooling and greater resistance to bending fatigue.

AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL CORPORATION, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

U·S·S AMERICAN TIGER BRAND WIRE ROPE

Excellay Preformed

USS

UNITED STATES STEEL

BEAIRD-INGERSOLL-RAND

Packaged Compressor Plant

Lowest Cost Per Horsepower Installed

Triples Production—

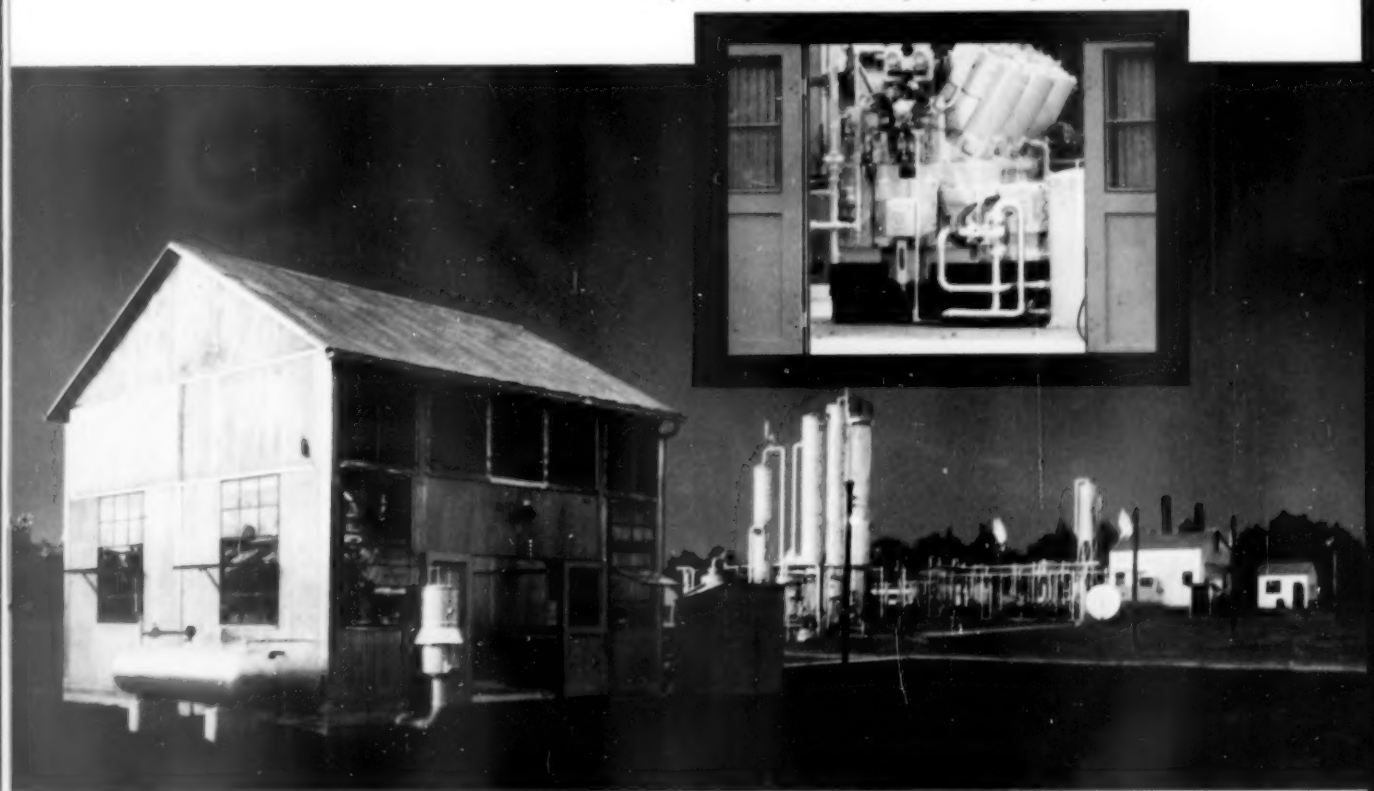
PACKAGED COMPRESSOR MAKES FLEXIBLE INSTALLATION

ARKANSAS LOUISIANA GAS COMPANY had seven wells in the Rodessa Field where wellhead pressures had dropped below the pressure of the gathering lines. Formerly good producers, the wells still contained profitable reserves that could be recovered by lowering gathering line pressure. To put the wells back into production economically, a 330 h.p. Beaird-Ingersoll-Rand Packaged Compressor Unit was installed at the Smithland, Texas, gasoline plant. Lowering pressure on the field line and boosting the gas through the plant and into the sales line, the unit tripled production from the wells.

Anticipating a relatively short life for the field, Arkansas Louisiana Gas specified that Beaird design the unit to meet a wide range of operating conditions. The flexibility of this design will permit the unit to be moved without change, to other service. Completely assembled and mounted on its own steel base it required a minimum in the way of permanent foundation and connecting piping. This feature makes the installation almost wholly salvageable when moved.

Pioneers and leaders in the development of packaged compressor plants — Beaird offers you proven equipment with an outstanding record of successful operation over a wide range of service.

Let us show you how a Beaird-Ingersoll-Rand packaged compressor plant can be designed to meet your requirements.



Arkansas-Louisiana-Gas Company's Smithland, Texas, packaged compressor plant — equipped with an Ingersoll-Rand 330 h.p. 8SVG gas engine driven compressor, Young radiator and all necessary equipment and controls. Other sizes 110 h.p. to 660 h.p. The steel deck has been mounted flush with the flooring at the option of the purchaser.

THE J. B. BEAIRD COMPANY, INC.
Shreveport, Louisiana

BEAIRD

MACHINING MANUFACTURING STEEL WAREHOUSE

PACKAGED COMPRESSOR PLANTS

CAST STEEL FITTINGS

PRESSURE BULK STORAGE

ANHYDROUS AMMONIA EQUIPMENT

LP-GAS SYSTEMS

Do you have this MARVEL Inverse Oiler on your { GASOLINE / BUTANE / or / DRY GAS } engine?

then you should use this MARVEL MYSTERY OIL in the Oiler!

Here's a carefully engineered pair to improve performance of any engine . . .

The *Marvel Inverse Oiler* is designed to feed *Marvel Mystery Oil* in exact proportion to engine speed and load. Prevents excess wear on valve stems and guides . . . keeps upper piston rings free to move in their grooves . . . retards ring flutter . . . and cushions ring pounding which can result in ring breakage. In addition, *Marvel Mystery Oil* reduces cylinder wall wear, and gives assurance against valves sticking. Remember, it is *the oil* which must do these things and only *Marvel Mystery Oil* is blended for this purpose and for this oiler. Over 30 years of exceptional performance.

This Chart shows the proper setting for constant load engines

BRAKE H. P. AT BELT	NAT. GAS CU. FT. PER HOUR	BUTANE GALLONS PER HOUR	GASOLINE GALLONS PER HOUR	M. M. OIL DROPS PER MIN.	M. M. OIL HOURS PER QUART
10	115.	1.07	1.12	4	226
15	172.5	1.60	1.68	6	152
20	230.	2.14	2.24	8	114
25	287.5	2.67	2.80	10	91
30	345.	3.21	3.36	12	76
35	402.5	3.74	3.92	14	65
40	460.	4.28	4.48	16	57
45	517.5	4.81	5.04	18	50
50	575.	5.35	5.60	20	45
60	690.	6.42	6.72	24	38
70	805.	7.49	7.84	28	32
80	920.	8.56	8.96	32	28
90	1035.	9.63	10.08	36	25
100	1150.	10.70	11.20	40	22
120	1380.	12.84	13.44	48	19
140	1610.	14.98	15.68	56	17
160	1840.	17.12	17.92	64	14
180	2070.	19.26	20.16	72	12
200	2300.	21.40	22.40	80	11
225	2587.5	24.00	25.20	90	10
250	2875.	26.75	28.00	100	9
275	3162.5	29.42	31.10	110	8
300	3450.	32.10	33.60	120	7

EXAMPLE:—If you use 805 cu. ft. of dry gas, 7.49 gallons of butane or 7.84 gallons of gasoline, your H.P. is about 70, so adjust oiler to feed 28 drops per minute. You will then receive about 32 hours per quart of MARVEL MYSTERY OIL.

If engine load increases after setting for normal load, oiler will automatically increase its feed, or decrease its feed when load is lessened.

When more than one oiler is used

To determine drop count per oiler when more than one oiler is used on an engine—divide recommended drop count by number of oilers.

NOTE: Guarantee on oiler is void if any other oil than MARVEL MYSTERY OIL is used therein. Some *engines* also carry this guarantee policy.

See Your Local Jobber or Oil Well Supply House

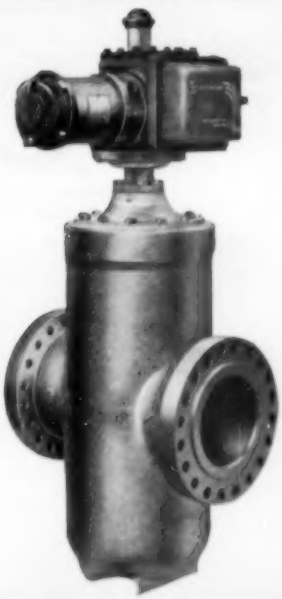
EMEROL MFG. CO. Dept. 373, 242 West 69th Street, New York 23, N. Y.

Only 60 Seconds

To open a 24" gate valve

...instead of 12 to 15 minutes

with **Limitorque**



Think of the saving in man hours that could be effected in a year's time by the use of LimiTorque—not to mention the elimination of key men climbing to out-of-the-way, often times hazardous locations of important valves . . . Then too, when LimiTorque opens or closes valves, by the *"mere push of a button,"* the valves are operated at just the correct speed . . . and if an obstruction is encountered in closing, LimiTorque shuts off the motor, thereby preventing any possible damage to the valve seats, stems, discs or gates.
LimiTorque is operating thousands of valves throughout the World . . . day and night, on land and sea, in hot and sub-zero climates, indoors and outdoors . . . *Speedily—Safely—*and *Dependably.* LimiTorque Motor Operated Valves are readily adapted to Microwave Control.

Send for catalog L-54—and remember, *far more valves are operated by* LimiTorque than any other valve control.

Philadelphia Gear Works, INC.

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.

NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.

Industrial Gears and Speed Reducers
LimiTorque Valve Controls

The Cylindrical Plug provides full pipe area that *stops erosion* from materials in suspension at this **CEMENT PLANT**. Outstanding performance since 1937!

In **SEWAGE PLANTS**, a.c.f. Cylindrical Plug shears obstructions on raw sewage and sludge lines or, as here, controls gas for heat booster on digestor circulating water.

PROOF OF SUPERIORITY

acf CYLINDRICAL FULL PIPE AREA PLUG VALVES

Representatives in 50 Principal Cities

Write for descriptive catalog 4-OG, ACF Industries, Incorporated, Valve Division, 1501 E. Ferry Avenue, Detroit 11, Michigan.

Quick, quarter-turn shut-off provides positive, immediate control vital to this **NATURAL GAS OPERATION**. Straight-through streamline flow in a.c.f. Valves assures least turbulence and pressure drop at all times.

In **PROCESSING PLANTS**, a.c.f. Valves provide dependable control of fluids in steady performance in this vital operation for 5 years. Now you get new dependability with **TEFLON* HEAD GASKETS.** *A DUPONT PRODUCT

Continental Red Seal®

MEANS MORE AND BETTER POWER

The equipment builder who powers his product with Continental Red Seal engine – and the user of such equipment–both benefit from specialized experience that goes back a long, long time. They profit by engineering features, and advances in production technique, evolved over a period of more than 50 years. Ever since 1902, Continental dependability, economy, and stamina have been building prestige for quality leaders in the transportation, farm and industrial equipment fields– in oil field producing, distribution, processing . . . providing more and better power, at lower over-all cost.

A COMPLETE LINE OF 4-CYCLE AIR-COOLED ENGINES

Continental also builds air-cooled models, from 2 to 3 h.p., for heavy-duty applications in industry and on the farm. They embody the exclusive Contex® external ignition system, greatest air-cooled engine advance in recent years. For information, address Air-Cooled Industrial Engine Division, 12800 Kercheval Avenue, Detroit 15, Michigan.

0 EAST 45TH ST., NEW YORK 17, NEW YORK • 6218 CEDAR SPRINGS ROAD, DALLAS 9, TEXAS • 3817 S. SANTA FE AVE., LOS ANGELES 58, CALIF.
918 S. BOSTON ST., ROOM 1008, TULSA, OKLA. • 1252 OAKLEIGH DRIVE, EAST POINT (ATLANTA) GA.

Continental Motors Corporation

MUSKEGON, MICHIGAN

PARTS AND SERVICE COAST TO COAST

The leader has lengthened its lead!

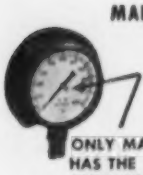
From the day it was announced, the Marsh Mastergauge took the lead in the pressure gauge field. You are probably well aware of this . . . but do you realize that we have constantly given it plus qualities to still further *lengthen* its lead?

Look at the recent developments presented opposite. Unquestionably these are the three greatest strides in gauge development since the creation of the Marsh "Recalibrator."

Yes, the three basic gauge components have been brought to a remarkable stage of perfection in the Mastergauge. Certainly, for every critical service there is no gauge to compare with it!

Mastergauge is standard bearer for the world's broadest line of gauges and dial thermometers, each the best of their kind in the applications for which they are recommended. Ask for data covering your specific needs.

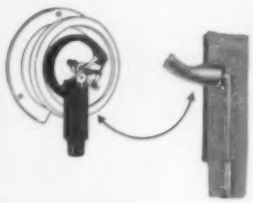
MARSH INSTRUMENT CO. *Sales Affiliate of Jas. P. Marsh Corporation*
Dept. L., Skokie, Ill.



ONLY MARSH HAS THE "RECALIBRATOR"

MARSH

THE STANDARD OF ACCURACY

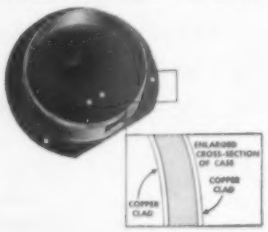


1—A better tube construction—

The Mastergauge always had the most effective joining of the bourdon tube to the socket . . . but . . . one-piece *construction is always better!* Welding these dissimilar parts posed a tough problem . . . but we finally solved it by a new process—the "Canoweld" process—exclusively ours. The photo of an actual section shows the perfect fusion. Socket, tube—even the end-piece—are fused into one leak-tight unit.

2—A better movement—

To convert the action of the bourdon tube into accurate pressure indication, the gauge movement must be rugged, practically frictionless, highly resistant to corrosion. A self-lubricating effect is achieved in the Mastergauge movement by using alternate stainless steel and monel—gears stainless, bushings "K" monel, and so on. A distinguishing feature is the "coined" sector gear. Note broad face of gear which results from this coined extrusion.

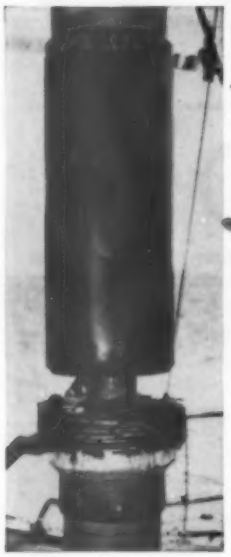


3—A better case—

Another development that has increased Mastergauge leadership is the new copper-clad, wrought steel case. The case has the strength of steel and the resistance to corrosion of copper. It is four times as strong as a cast iron case and one-third lighter. Final finish is a handsome corrosion resistant black enamel. Every case is fitted with Marsh safety blow-out plug—a typical advancement.

NOW - only JOHNSTON provides this new, field-proven testing method!

with BOB TAIL PACKER and HYDRAULIC TESTER



THIS . . . Actual photo of the new Bob Tail Packer coming out of the hole without any extrusion or flow of the rubber packing element!

NOT THIS . . . Typical example of the extrusion that occurs on conventional packers — now practically impossible with the new Bob Tail Packer!

BOB TAIL PACKER

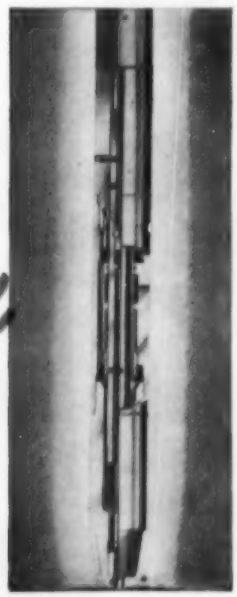
Absolutely Prevents Extrusion! You get the tightest seal it's possible to produce . . . a **perfect** seal. With the Bob Tail Packer there's **no** extrusion, **no** flow of the rubber packing element! Here's why the new Bob Tail Packer makes such a big difference:

★ **Pack-Off Is Up To 30% More Effective!** Metal petal cups at base of packer hold the rubber in the pack-off zone! Rubber **can't** flow or extrude down the lower packer assembly!

★ **Up to 3 Times MORE Clearance** when going in the hole. The Bob Tail utilizes entire volume of rubber in the pack-off zone. Loses none to extrusion—so a much smaller diameter is effectively used.

★ **Removes Easily From Packer Seat** after the test is completed, rubber is intact, thanks to the special design.

Type B Hydraulic Tester prevents shock to formation, pipe and instruments and needs **less** water cushion!



TYPE B HYDRAULIC TESTER

Prevents Shock To Test Zone by releasing pressure **slowly** below the packer! The Type B Hydraulic Tester opens in stages during 2½ to 4 minutes . . . allows spudding through tight spots you may find in open or uncased hole!

Positive Operation for Positive Interpretation! The compact, self-contained Johnston Hydraulic Tester opens by applying drill pipe weight, closes by removing weight! Functions smoothly **every** time—reduces plugging and damage to wall of hole.

See The Difference this super-accurate testing team can make for you! Remember, it's always Johnston **first**—in speedy service, in new developments for **accurate** testing!

JOHNSTON TESTERS

first in drill stem testing

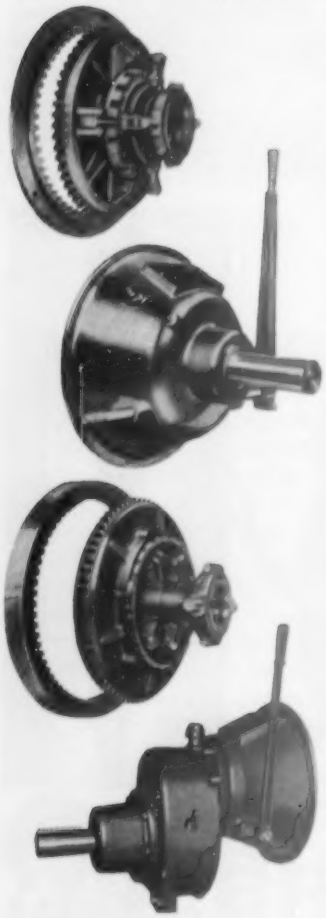
HOUSTON, TEXAS

LOS ANGELES, CALIF • CALGARY, CAN.

C0542

FORMATION AND CASING TESTING — JOHNSTON

SERVICE
for
ROCKFORD
Heavy Duty
CLUTCH AND POWER TAKE-OFF USERS



ROCKFORD Heavy Duty CLUTCHES, POWER TAKE-OFFS and SPEED REDUCERS are standard equipment on various makes of industrial engines. They are available in standard sizes ranging from 125 foot pounds to 2100 foot pounds torque. Clutch sizes range from 6½ to 18 inches, single and double plate — to fit standard S. A. E. flywheel housings. These complete, self-contained power take-off units are being used extensively for heavy duty gear-tooth drive type application to gasoline and diesel engine powered drilling, pumping and servicing rigs. Their precision manufacture, conservatively rated capacity, field proved stamina and unusual ease of adjustment are lowering upkeep costs throughout the petroleum producing areas.

Send for This Handy Bulletin

Gives dimensions, capacity tables, specifications and typical applications of ROCKFORD CLUTCHES and POWER TAKE-OFFS.

ROCKFORD CLUTCH DIVISION
BORG-WARNER
1309 Eighteenth Avenue, Rockford, Illinois

These ROCKFORD DISTRIBUTORS and DEALERS carry a stock of clutches, power take-offs and replacement parts to insure ROCKFORD clutch users prompt delivery and service.

Continental Sales & Service Company, Los Angeles, Calif.
Lightbourn Equipment Company, Dallas, Texas
Atlas Auto Parts & Grinding Co., Louisville, Kentucky
Wepco Equipment Company, Cleveland, Ohio
Genuine Motor Parts, Pittsburg, Pa.
Auto Clutch & Parts Company, Chicago, Illinois
Auto Gear & Parts Company, Philadelphia, Pa.
General Machine Parts, New York, N. Y.
Highway & Industrial Equipment Co., Inc. Raleigh, N. Carolina
R. Angus (Alberta) Ltd., Edmonton, Alberta, Canada
Mease Equipment Co., Ltd. Montreal, Canada
B-W-H Service Parts, Ltd., Merritton, Ontario, Canada
Credle Equipment Company Utica, New York
Engine Service & Supply Company Odessa, Texas
National Supply Engine Corp. Portland, Ore. and Seattle, Wash.

Wherever industry uses heavy duty clutches or power take-offs there is a ROCKFORD distributor conveniently close at hand to supply ROCKFORD Heavy Duty CLUTCHES, POWER TAKE-OFFS and replacement PARTS for numerous types and sizes of each.

IN THE OIL FIELD

LOOK FOR THE GREEN RODS

Ordinary steels do not pass the high requirements set for Jones sucker rods. Only carefully selected steels that meet laboratory tests are acceptable. What's more, they must pass a series of controls throughout fabrication. This is another assurance of uniform quality when you run the green rods.

JONES SUCKER RODS

PESA

PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION

PARTNERS IN PETROLEUM PROGRESS

THE S. M. JONES COMPANY

Division of Buffalo-Eclipse Corporation

General Office and Factory: TOLEDO, OHIO

Sales Office: Kennedy Building, TULSA, OKLA.

Export Sales Office: Buffalo International Corp.
50 Church Street, N. Y. C.

HOW A DRILLER

HITS THE

Jack Pot!

SpringKore rotary drilling line, Blue Ribbon steel in drill pipe and J&L quality in all tubular goods, Ideco rotary equipment, PlastiKore wire rope for cable tool drilling . . . these are major examples of mature judgment in distribution resulting from almost 50 years of close cooperation with drillers.

But another important J&L contribution to efficient drilling is the consistently critical selection of items the driller has little time to investigate . . . such readily expendable but, in the aggregate, expensive items as catlines, rotary, vibrator and suction hose, V-belts, and pump and swivel packings.

We see to it with every faculty and resource at our command that a driller who does business with J&L hits the equipment jack pot!

J&L STEEL

"...here's MY warehouse!"

Jones & Laughlin STEEL CORPORATION

SUPPLY DIVISION — TULSA, OKLAHOMA

Serving The United States and Canada

P·E·S·A

PARTNERS IN PETROLEUM PROGRESS

After

THE PAY IS

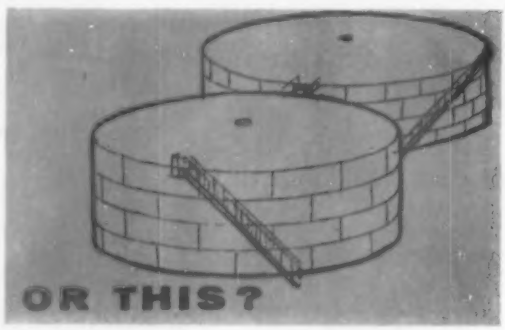
LOCATED

comes the big question

HOW MUCH?

Today, in many areas, operators who ask Lane-Wells that question are getting the answer—and getting it right. For Lane-Wells' QUANTITATIVE INTERPRETATION of Radioactivity Well Logs, wherever formation responses permit such interpretation, are providing estimates of reservoir potential which have been proved to be sufficiently accurate for all commercial purposes. The value of such data to men charged with the responsibility of planning production for maximum recovery can hardly be overestimated.

This service is being extended to other areas as rapidly as new or improved techniques are proved reliable and as sufficient other down-hole information is obtained and correlated to produce trustworthy results. Your Lane-Wells man can give you full information on the possibilities of QUANTITATIVE INTERPRETATION in your area and its value to your operations.



Tomorrow's Tools—Today!

let us tell you how QUANTITATIVE INTERPRETATION may give the answer

LANE-WELLS COMPANY

LR-82-A

Radioactivity Well Logging

General Offices, Export Office, Plant • 5610 So. Soto St., Los Angeles 58

LOS ANGELES • HOUSTON • OKLAHOMA CITY • LANE-WELLS CANADIAN CO. IN CANADA • PETRO-TECH SERVICE CO. IN VENEZUELA

7 pounds, 6 oz.–rarin' to go!

How much weight to a horsepower? Take one of our P&H Diesels — divide its weight by its power — and that's the figure you get.

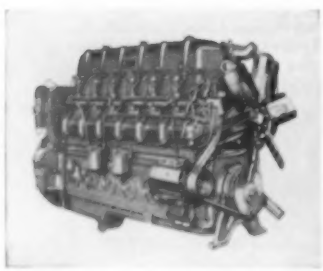
The reason we're so proud of our baby: at 7 pounds, 6 ounces this horse is full grown! No competing diesel can produce a full horsepower to that amount of weight. Pound for pound, this engine out-powers them all.

Dollar for dollar, too. A P&H will give you more horsepower per dollar than any other diesel. And just as a sort of extra, it's also the easiest to service!

Not that it will need much servicing. Actually, a P&H Diesel takes less of it than the old gasoline engine. Its fuel cost: *about one-third*.

Some baby!

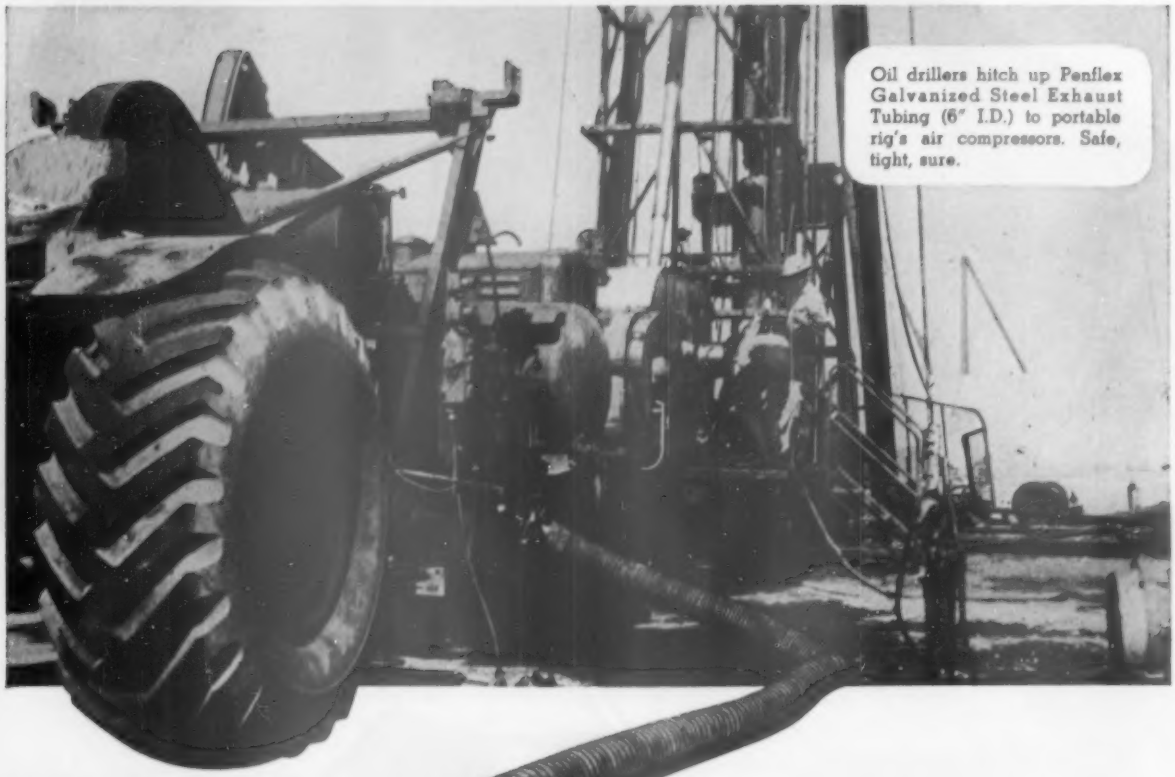
P&H Diesel Engine Division, Harnischfeger Corporation, Crystal Lake, Ill.



Horsepowers, 30 to 255. Two-cycle. 2, 3, 4, 6-cylinder models. Speeds to 1800 rpm. Stationary, mobile, marine. Diesel-generator sets

THE P&H DIESEL

lowest price per horsepower . . .
lowest weight per horsepower



Oil drillers hitch up Penflex Galvanized Steel Exhaust Tubing (6" I.D.) to portable rig's air compressors. Safe, tight, sure.

PENFLEX holds air, gas, volatiles, granulars tight

Huge oil storage tank "walks" with the weather thanks to Penflex four-wall Interlocked Tubing of Galvanized Steel (12" I.D.), and tight-packed flanges.

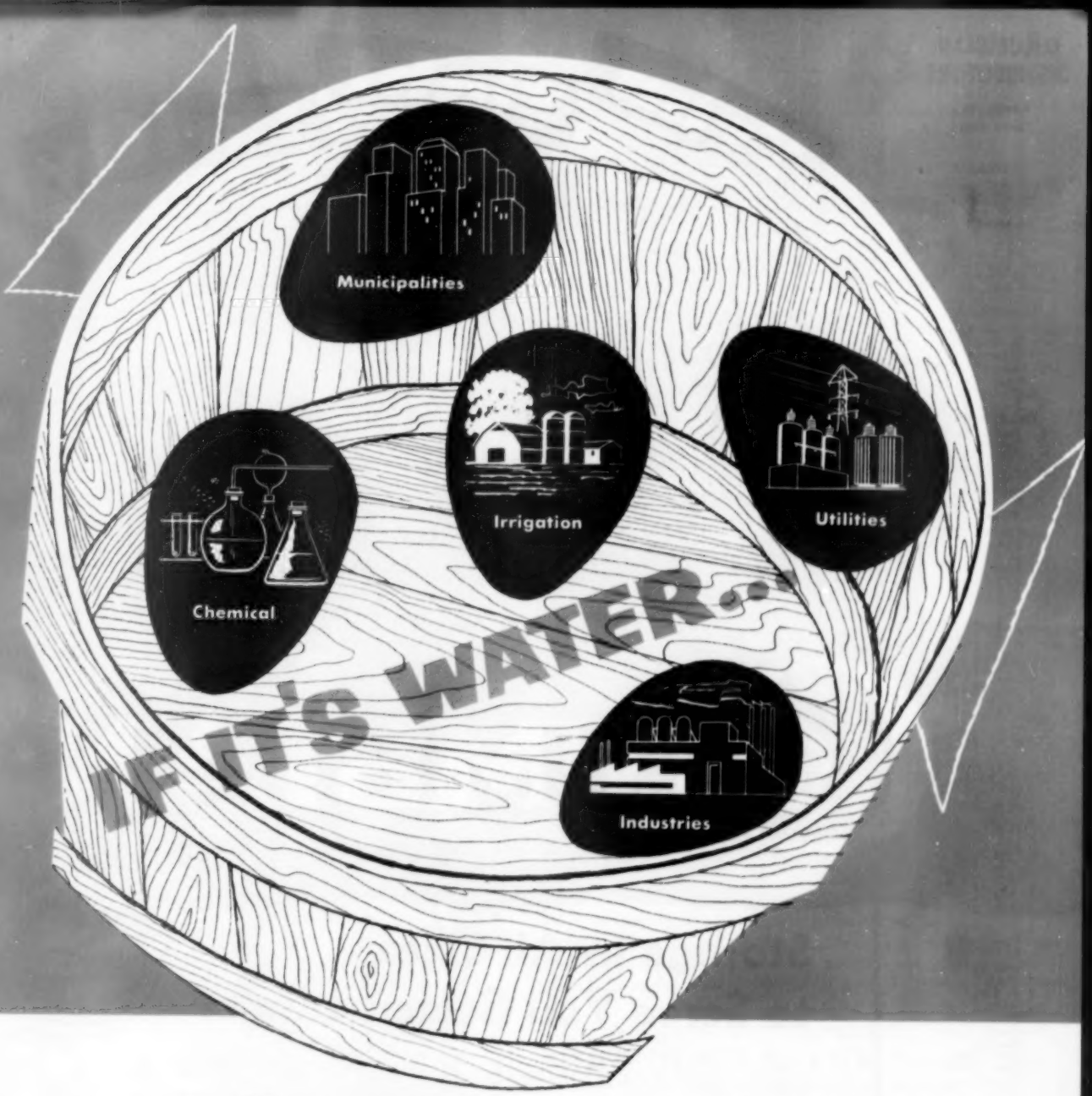
Exhaust gases sneak through ordinary flexible hose—but not through Penflex. Its four-wall interlocking design, with or without packing, holds tightly whatever you convey . . . gases, liquids or granulars.

Penflex has hundreds of applications in the oil and gas fields and a complete tubing assembly specific to each. Drilling, for example, illustrated above. Pipeline laying . . . where Penflex pipes hot tar and asphalt from heater to painting and wrapping machine. Processing . . . where Penflex seals pipe joint assemblies on petroleum still burners. Storage . . . where Penflex provides flexible but leakproof connections for huge tanks. The list of applications is lengthening daily.

Write for "Flexineering", your guide in buying and using Penflex Interlocking and Corrugated Tubing, and Penflexweld, the High-pressure Tubing for service where leaks are fatal. No charge or obligation.

Pennsylvania Flexible Metallic Tubing Company, Inc., 7213 Powers Lane, Phila. 42, Pa.
Branch Sales Offices: **Boston • New York • Chicago • Houston • Cleveland • Los Angeles and Distributors in Principal Cities**

COMBINES FLEXIBILITY WITH DURABILITY



.... put all your eggs in one basket!

Whether it's water for municipality—industry—or farm, divided responsibility is dangerous. Put your eggs, all your eggs in one basket. Layne—the world's largest developer of ground water resources—offers a service that is truly unique. From preliminary exploration through well drilling to installation of equipment, you do business with one organization that assumes complete and undivided responsibility for the finished system. Wise men know that on any question that relates to water—it's good business sense to talk first to Layne.

LAYNE & BOWLER, INC.
Memphis 8, Tennessee

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Water Wells • Vertical Turbine Pumps • Water Treatment

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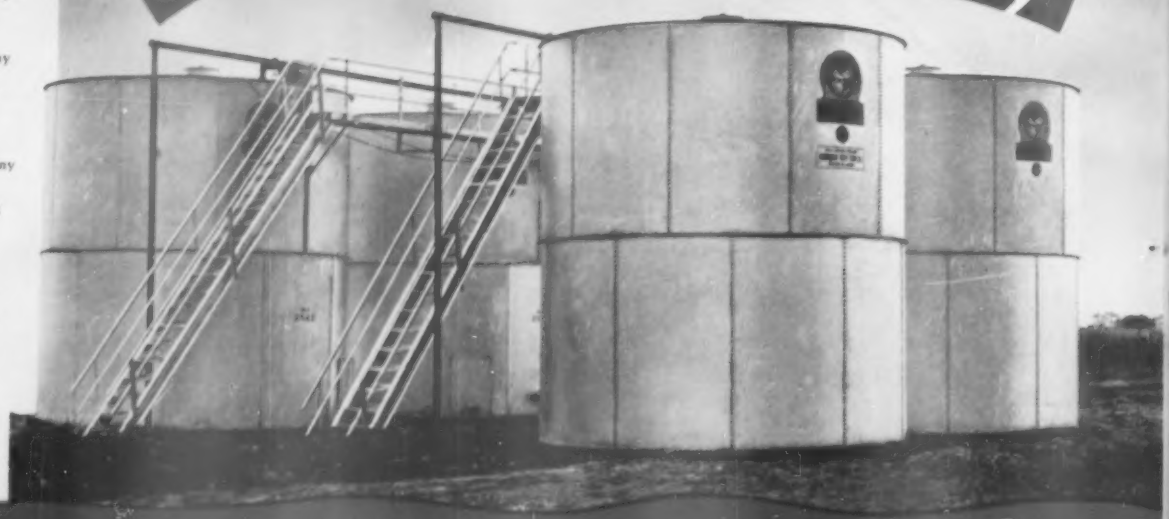
Trim Tight Thrifty



COLUMBIAN
BOLTED STEEL TANKS

Storage in All Sizes . . . to Serve You Better, Longer

If you have a need for storage . . . regardless of the difficulty of your problem . . . Columbian is the answer. It is that simple. Throughout long years of leadership in storage tank design and fabrication, Columbian has overcome many oil industry problems. Today, Columbian continues to be first in the minds of oil men the world over. Exclusive construction features, rapid assembly, easy transport and long years on the job mean real dollar savings when you specify Columbian Bolted Steel Tanks. Write for fully illustrated, fact-packed free literature.

COLUMBIAN ALL-METAL BUILDINGS

And for that warehouse, garage, engine, equipment or storage house you need, use a Columbian Metal Building! Rigid, strong, fire-safe, weather-tight construction. Easily, quickly erected. Can be taken down for re-use. Require minimum maintenance. Get the facts today . . . write for complete details.

COLUMBIAN STEEL TANK CO., P. O. Box 4048-J, Kansas City, Mo.

FORD "134"
4-Cylinder
Engine Assembly
134 cu. in. displ.

FORD "172"
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Engine Assembly
172 cu. in. displ.

FORD "223"
6-Cylinder
Engine Assembly
223 cu. in. displ.

FORD "239"
V-8 Cylinder
Engine Assembly
239 cu. in. displ.

FORD "256"
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Engine Assembly
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FORD "317"
V-8 Cylinder
Engine Assembly
317 cu. in. displ.

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Here's a Choice of Six Large Bore, Short-Stroke, Low Piston Speed Engines . . . All of the Latest Overhead-Valve Type for Top Economy, and Longer Life.

Tests have proven conclusively that, in their respective displacements, these low-friction Ford engines deliver *more* usable power on *less* fuel. Also, short piston travel reduces wear, so that engines last longer. And remember, too, that parts and service are available through Ford Dealers everywhere.

Descriptive folders have been prepared on each engine, including outstanding features, power curves, dimensional drawings, complete specifications, standard equipment, accessories available for special needs. Phone or write us today.

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Closed Type Power Unit
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Typical Closed Power Unit
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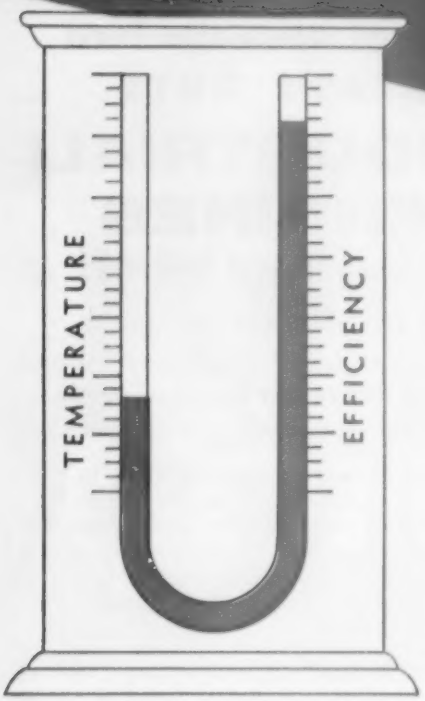
the LUFKIN Hydraulic LONG STROKE UNIT Runs COOL

LOW OPERATING TEMPERATURE MEANS HIGH EFFICIENCY!



FIELD TESTS HAVE PROVEN THAT LUFKIN RUNS COOLER THAN ANY HYDRAULIC UNIT ON THE MARKET TODAY

•

NO COOLING COILS OR HEAT EXCHANGERS REQUIRED

- LOW OPERATING PRESSURE.
- LARGE UNRESTRICTED FLOW PASSAGES REDUCE FRICTION LOSS
- PATENTED SELF REVERSING PUMP FOR CUSHIONED REVERSALS
- FULLY AUTOMATIC COUNTER-BALANCE

Lufkin FOUNDRY & MACHINE COMPANY

LUFKIN, TEXAS

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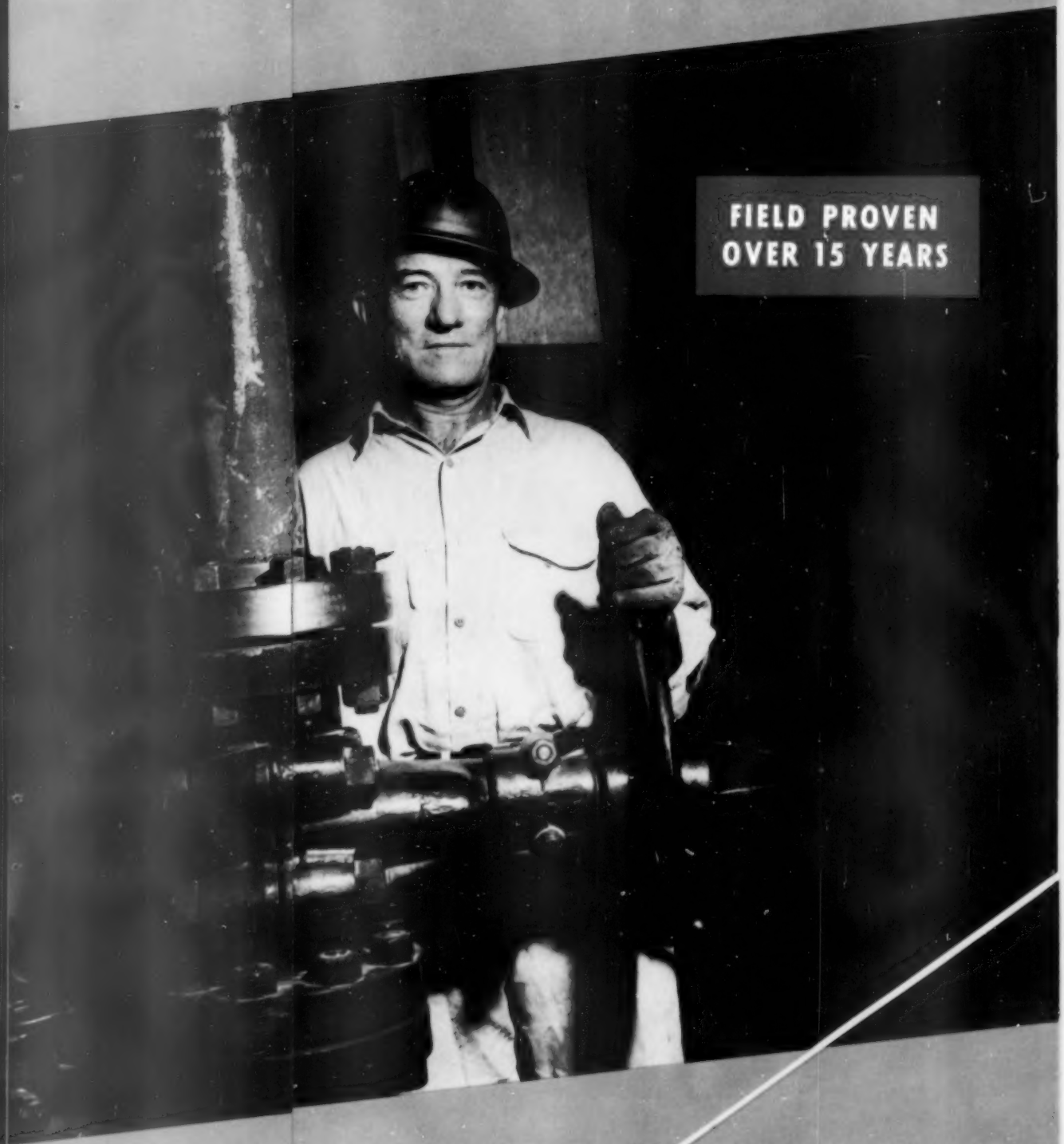
Lufkin equipment in Canada is handled by THE LUFKIN MACHINE CO., LTD., 14321 108th Avenue, EDMONTON, ALBERTA, CANADA

FLEX-SEAL by Cameron



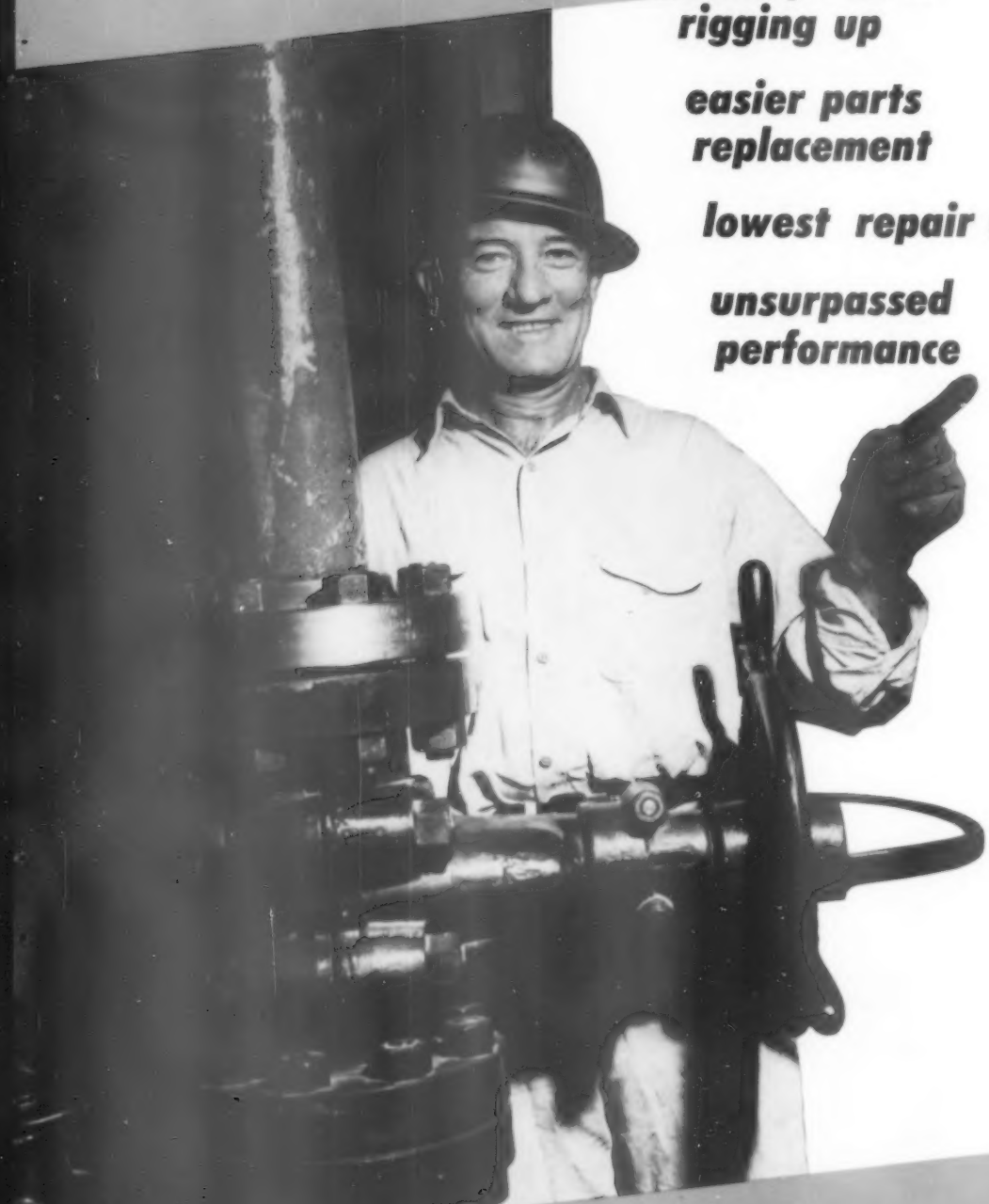
FLEXIBLE DESIGN . . .

For: easier, faster rigging up

easier parts replacement

lowest repair cost

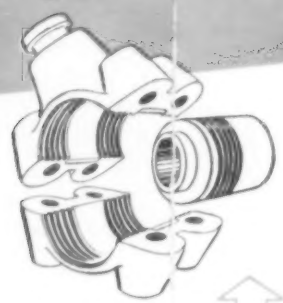
unsurpassed performance

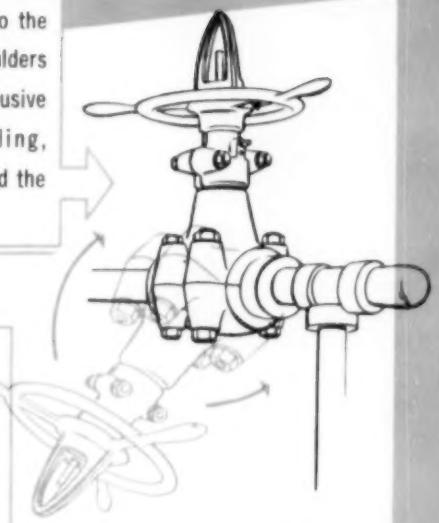


FLI
for
the
cou
bo
cre

This shou
of the ga
preventin
prolongin

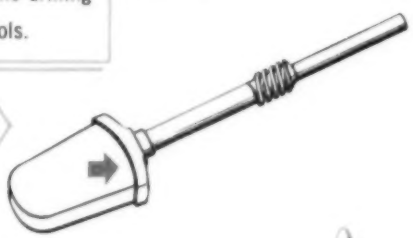
FLEX-SEAL is the only mud valve that serves as a union. The hubs are attached to the body by interlocking shoulders and grooves. This exclusive feature permits swiveling, saves rigging-up time and the cost of line unions.

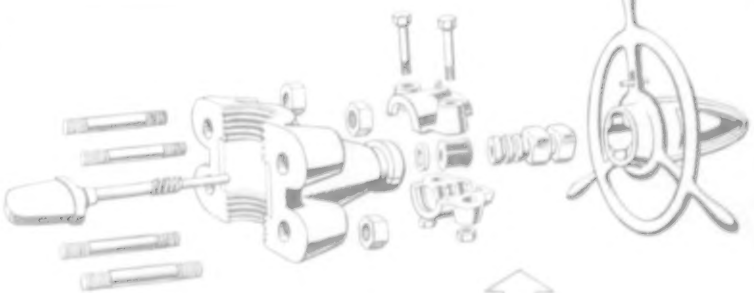




FLEX-SEAL design assures low cost maintenance. The body, for example, is in two pieces with the hubs separate. Should the valve become sand cut, it can be restored to its original condition by replacing an inexpensive part . . . not an entire body. The design is so simple that any member of the drilling crew can overhaul it completely with regular rig tools.

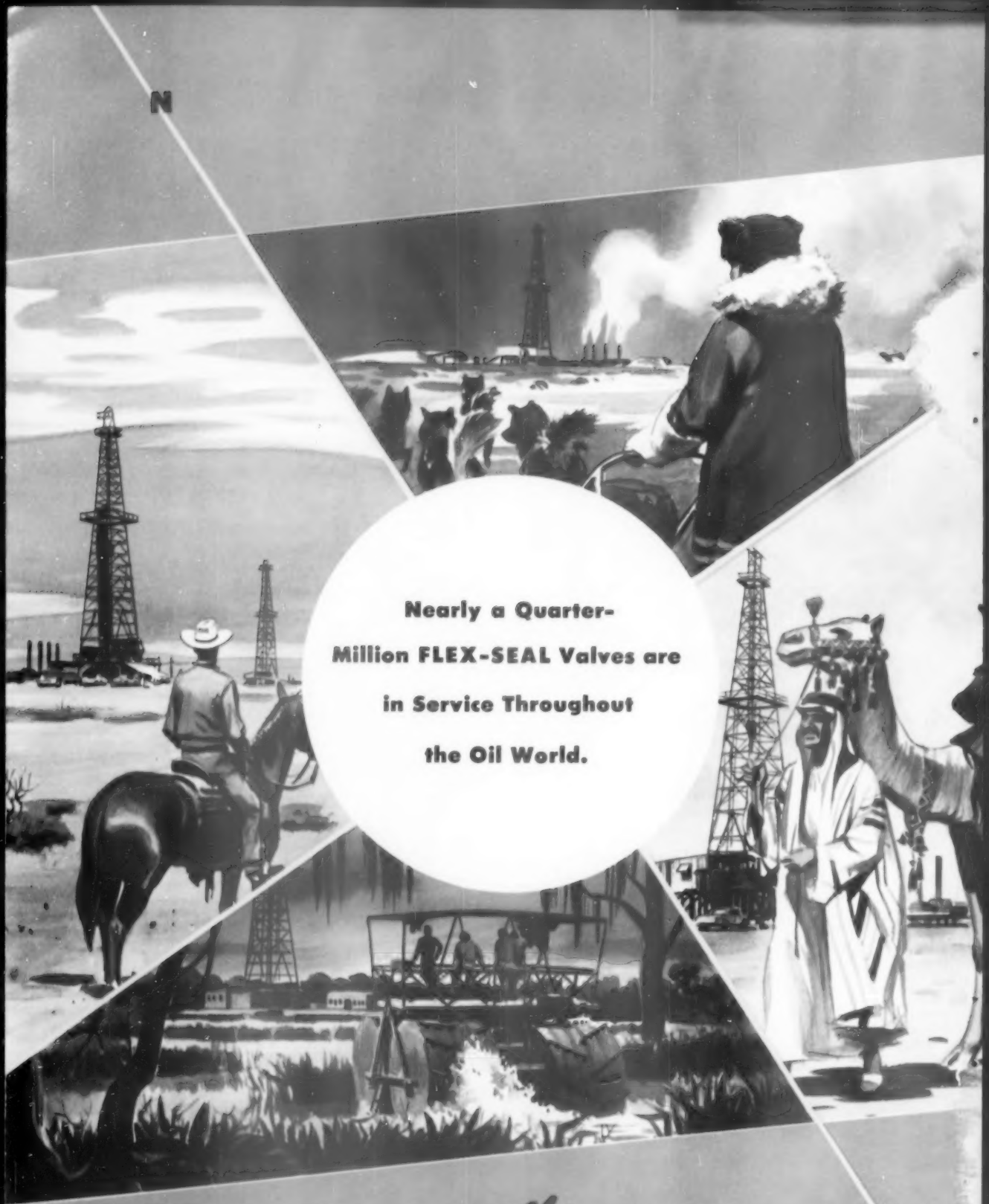
This shoulder on the Flex-Seal gate contacts the top of the gate packer when in the closed position, thus preventing "flowing" of the resilient packer and prolonging its life.





FLEX-SEAL Valves have a lot of parts and there's a good reason for it, each individual part is replaceable at a minimum of expense. The replacement of small, inexpensive parts and the elimination of costly delays, transportation, and valve repair shop charges, has found favor with cost-conscious operators the world over.

EXCLUSIVE WITH *Cameron*



Nearly a Quarter-Million FLEX-SEAL Valves are in Service Throughout the Oil World.

Cameron

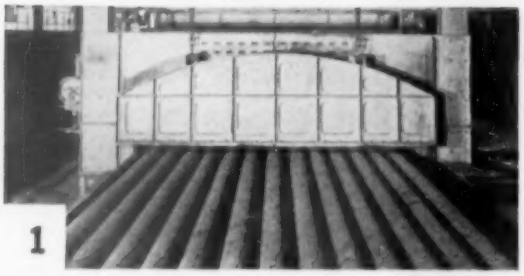
IRON WORKS, INC.

P. O. BOX 1212 • HOUSTON, TEXAS

Export Office: 7912 Empire State Bldg., New York City • In England: British Oilfield Equipment Co., Ltd., Duke's Court, St. James's, London, S.W. 1, England

Printed in U. S. A.

Here's why oil producers rely on
REPUBLIC ELECTRIC WELD CASING AND TUBING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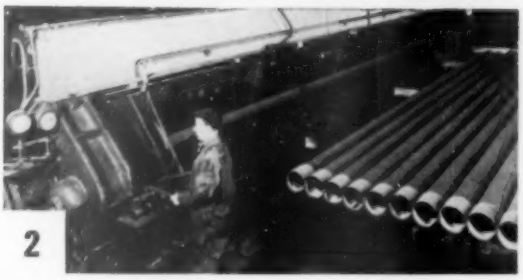
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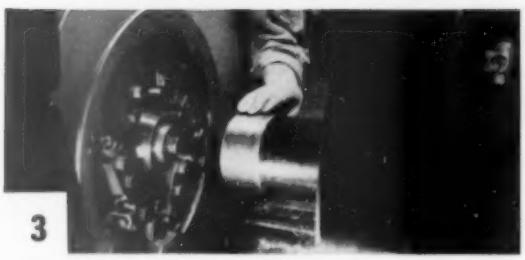
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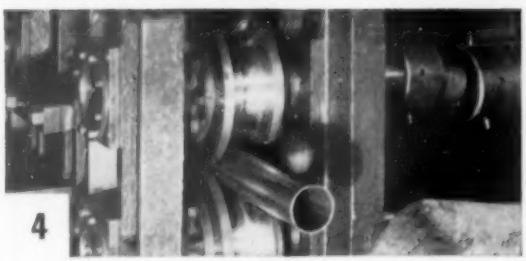

4

Actually, it can be summed up in two words—*dependable performance.*

Oil producers can't afford to make purchasing errors. Few people buy more carefully—or wisely. So naturally, we at Republic are extremely proud of our Electric Weld Casing and Tubing. It must be good. For the past 25 years oil producers have installed literally millions upon millions of feet all over the world.

Why? Here are four important reasons:

1 **Pipe is normalized for uniform strength.** This produces homogeneous grain structure, and ductility. Casing is then cold sized to increase high yield strength, thus providing extra resistance to collapse.

2 **Rigid tests safeguard quality.** Each length is carefully checked for uniform wall thickness and roundness, uniform strength and straightness. Both inside and outside surfaces receive visual inspection, and each length is subjected to hydrostatic pressure tests in accordance with Standard A.P.I.5A.

3 **Rugged threads resist pullouts.** Clean, full-formed threads stab, spin in, tong up fast—and tight. Uniform depth of tough steel under the thread roots around entire circumference helps protect against pullouts.

4 **Weld is strong, reliable.** Pipe is cold formed from flat-rolled steel—joined by strong electric-resistance weld without use of foreign metal. Weld area is as strong or stronger than wall itself.

REPUBLIC MAKES BOTH!

Republic Electric Weld Casing and Tubing is available in sizes 2⅜" through 13⅜" O.D. in grades H-40 and J-55. Republic also produces Seamless Casing and Tubing in sizes 2⅜" through 9⅝" O.D., in grades J-55 and N-80. For complete information contact your nearest Republic Pipe Distributor. Or write to:

REPUBLIC STEEL CORPORATION
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, New York

REPUBLIC
CASING AND TUBING
Electric Weld and Seamless

Other Republic Products include Line Pipe—Steel and Plastic Pipe—Carbon, Alloy and Stainless Steels—Studs, Bolts and Nuts—Heat Exchanger Tubes

"You see Powell Valves everywhere! And with . . .

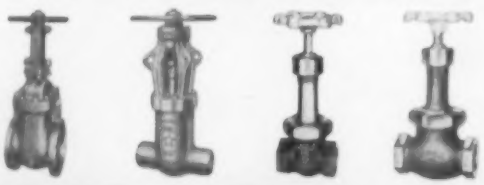
. . . good reason! They're famous for dependability. Economical, too.
What's more, Powell has a complete line."

Just name the valve needed...

. . . POWELL CAN SUPPLY IT! Small wonder—since Powell probably makes more kinds of valves and has solved more valve problems than any other organization in the world.

Available through distributors in principal cities. In bronze, iron, steel and corrosion resistant alloys. ⅛" to 30" and 125 pounds to 2500 pounds W.S.P. On problems, write direct to The Wm. Powell Company, Cincinnati 22, Ohio.

CONTROLS FOR THE LIFE LINES OF INDUSTRY



Powell Valves 108th year

THE PROOF IS IN THE FIELD . . .

Carter

Long-stroke Hydraulic Pumping Units

featuring the amazing **Variable-Cycle** *Principle*

Designed — Built — Priced FOR STRIPPER WELLS

CALIFORNIA

Carter Unit Pumping in Edna Field. Has been in service for seven years.

KANSAS

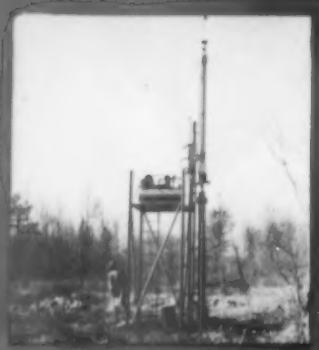
One of 4 units in the Greer Sand Area, pumping from 2400 ft., owned by large independent.

EAST TEXAS

One of 8 Carter Units owned by a major oil company in Kilgore and Turnertown Areas. Pumping allowable from 3500 ft. Total cost about 60% of the cost of a conventional unit.

OKLAHOMA

One of seven units owned by an independent in the Tulsa Area, pumping from about 1500 ft. Operator reports production holding up better than offsetting wells with conventional units.



KENTUCKY

Carter Unit on 15-ft. substructure in the Green River Bottoms. Operator saved about 20% on substructure cost alone. This is one of seven units owned by this independent.

NORTH TEXAS

One of company installation in Cooke Field, pumping 30 bbl/day from 6250 ft. No rod failures in more than a year's operation. Total cost about 50% of the cost of a conventional unit.

CANADA

Carter Unit operating at 50 degree-below-zero weather in the Carbondale Field, showing adaptability of Carter Unit to extreme climatic conditions.

SOUTH TEXAS

Production increased from 3½ bbl/day to 6 bbl/day on this 2700-ft well in the Duval County Area, when it replaced conventional equipment. This is one of 11 units owned by this independent.

WEST TEXAS

Carter Unit in the Sweetwater Area, pumping from 7000 ft. This unit was installed for about 50% of the cost of a conventional unit.

MORE THAN 800 UNITS NOW IN SERVICE!

MORE THAN EIGHT YEARS OF FIELD EXPERIENCE!

From Canada to the Gulf, from Ohio to the Pacific, Carter Long-Stroke Hydraulic Pumping Units are saving thousands of dollars, for majors and independents alike, through lower first cost and maintenance as well as increasing production in many cases.

WRITE FOR BULLETIN PR-253

S. C. CARTER COMPANY, inc.

1900 Santa Fe Avenue • Los Angeles, California

Sales and Service Representatives in —

Sales and Service Representatives in: ILLINOIS, INDIANA and KENTUCKY—Tamms Supply Company, Robinson, Salem, IL; Princeton, Evansville, Ind.; Irvine, Oil Springs and Owensboro, Ky. KANSAS, OHIO and WEST VIRGINIA—Barbers Supply Company, Chanute, El Dorado, Great Bend, Kansas; Wooster, Zanesville, Ohio; Vienna, W. Va. MICHIGAN—The Straker Supply, Mt. Pleasant. OKLAHOMA—Wilson Supply Company, Tulsa; G. & C. Machine & Equipment Co., Healdton. ARKANSAS, LOUISIANA, NEW MEXICO and TEXAS—Wilson Supply Company, Harvey, Houma, Lake Charles, New Iberia, Shreveport, La.; Alice, Barbers Hill, Bay City, Beaumont, Colombus, Corpus Christi, Houston, Kilgore, Liberty, Monahans, and Victoria, Texas; Beacon Supply Company, Borger, Pampa, Texas. ROCKY MOUNTAIN AREA—Swan Specialties Co., Casper, Wyo.; Emrick Oilfield Management Co., Conrad and Cut Bank, Montana.

EXPORT: CANADA—Engineering Specialties Co., Edmonton; COLOMBIA and VENEZUELA—Wilson, S. A., Caracas, Maracaibo and Puerto la Cruz. TRINIDAD—Wilson and Johnstone Ltd., Port of Spain.

This Simple Compressor Meets the Complex Needs of a Changing Petroleum Industry

It's the Nash!

Here is a compressor presenting advantages found in no other device. Nash Compressors have only one moving part, rotating without metallic contact with the pump casing. No internal lubrication is required. Yet they produce 75 lbs. pressure in a single stage, with capacities to 6 million cu. ft. per day in a single structure.

There are no valves, gears, pistons, sliding vanes, or other complicated wearing parts in a Nash. Compression is secured by an entirely different principle of operation. Because of this, gas pumping problems difficult with ordinary pumps are often easily handled by the Nash. For example, Nash Pumps are standard equipment in the Synthetic Rubber Industry, where they have met the needs of new and difficult processes.

Nash Compressors are compact and save space. They run without vibration, and compression is without pulsation. They maintain original performance over long periods. Service is assured by a nationwide net-work of Engineering Service offices. Instructive bulletin shows how they operate. Write for it.

One moving part.

No internal wearing parts.

No valves, pistons, or sliding vanes.

No internal lubrication.

Low maintenance.

Slugs of liquid entering pump do no harm.

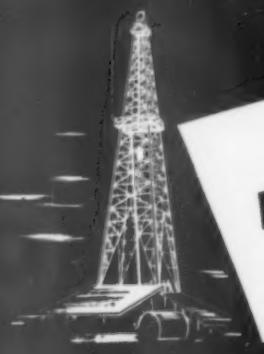
Non-pulsating pressure.

Saves floor space.

75 pounds in a single stage.

NASH ENGINEERING COMPANY

311 WILSON, SO. NORWALK, CONN.



DELIVERS EXTRA POWER TO THE BOTTOM OF THE HOLE

Faster drilling takes more pressure and more horsepower at the bottom of the hole. The Wheland HP-14000 Pump can handle the power and deliver the mud with that extra pressure that makes hole in a hurry. This pump often makes the difference between profit and loss on a drilling contract. It saves drilling time and bit costs.

The Wheland HP-14000 delivers the best balance of pressure and volume for jet drilling operations. Like any pump used on jet drilling, for maximum speed and depth it must be fitted with proper size liner and run at correct speed and pressure in relation to:

1. Size, condition and depth of hole.
2. Type and size of drill pipe, drill collars, and jets in bit.

WRITE FOR DETAILED BULLETIN
and data sheets of actual jet drilling performance

WHELAND

HP-14000 7½" x 14"

DUPLEX SLUSH PUMP

350 HORSEPOWER
NOMINAL INPUT AT 60 R.P.M.

Discharge pressure with 7½" liners 838 PSI

Discharge pressure with 5½" liners 1627 PSI

WHELAND

THE WHELAND COMPANY, CHATTANOOGA, TENN., U. S. A.
ROTARY DRILLING MACHINERY

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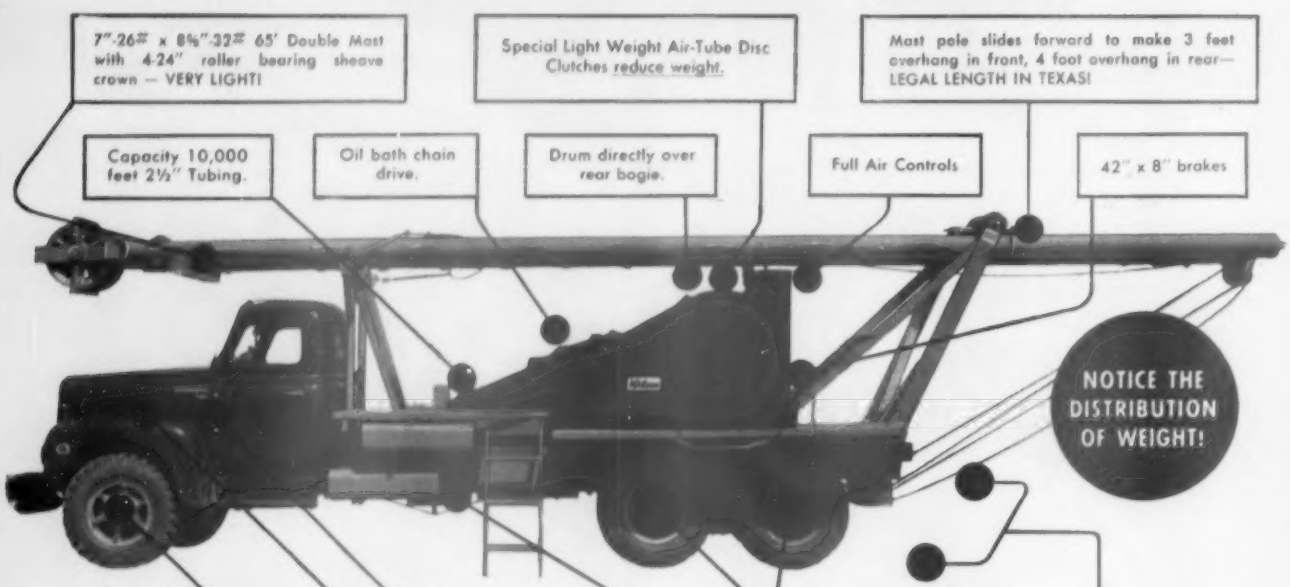
EXPORT DISTRIBUTOR: Lucey Export Corporation, 233 Broadway, New York 7, New York—Broad Street House, London, E. C. 2, England

WEIGHT— IS IMPORTANT IN DEEP WELL SERVICING WINCHES

To conform with the legal weight, length and width set up by the individual states, WILSON has developed the Mogul "42." This winch is undoubtedly the most modern winch in the field and is rapidly gaining great popularity. This modern winch has been combined with the New Wilson Heavy Duty Truck POWER-TAKE-OFF and the new Wilson Masts to make a COMPLETE WELL SERVICING UNIT that meets all weight requirements.

LOOK AT THESE SPECIAL FEATURES


7"-26# x 8¾"-32# 65' Double Mast with 4-24" roller bearing sheave crown — VERY LIGHT!
Special Light Weight Air-Tube Disc Clutches reduce weight.
Mast pole slides forward to make 3 feet overhang in front, 4 foot overhang in rear— LEGAL LENGTH IN TEXAS!
Capacity 10,000 feet 2½" Tubing.
Oil bath chain drive.
Drum directly over rear bogie.
Full Air Controls
42" x 8" brakes
NOTICE THE DISTRIBUTION OF WEIGHT!
7,860 pounds on front axle.
International RF-192 Truck
23,660 pounds on rear bogie.
Total weight 31,520 pounds.
International RD-450 or RD-501 engine.
Wilson Heavy Duty Truck Power Take-Off eliminates extra engine weight.

MOGUL "42" COMPLETE WELL SERVICING UNIT

DON'T BUY AN OBSOLETE WINCH— BE MODERN . . . BUY WILSON!

Wilson

—The FIRST NAME in OIL FIELD WINCHES

WILSON MANUFACTURING CO., Inc.

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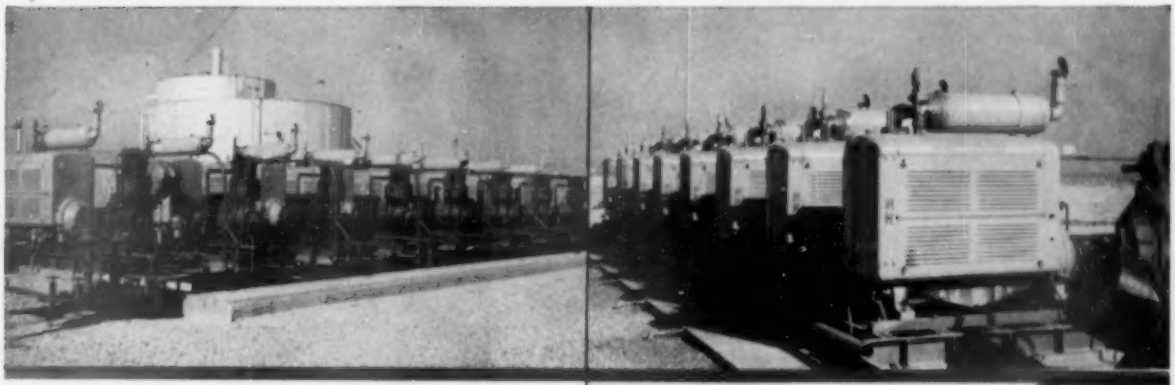
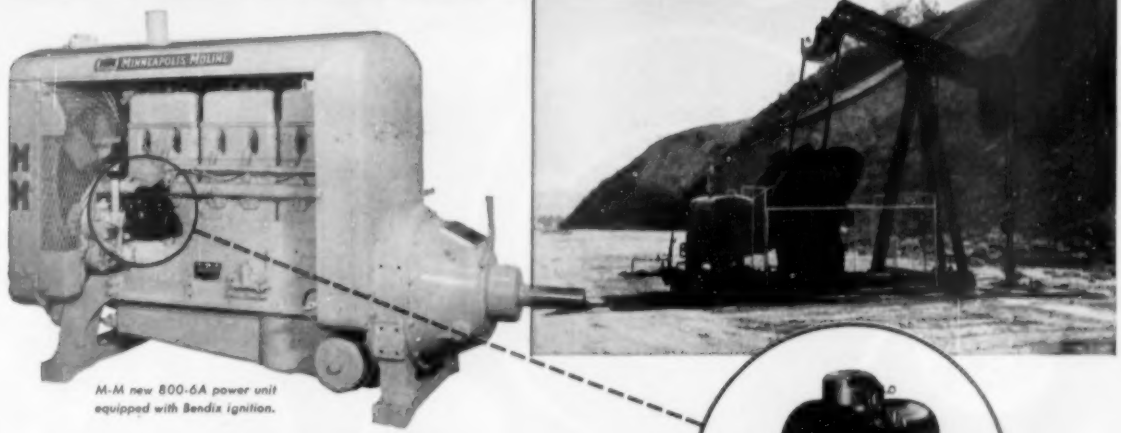
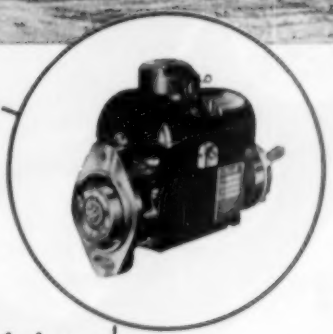
More power to the oil fields...





M-M new 800-6A power unit equipped with Bendix ignition.



with Minneapolis-Moline power units and Bendix ignition

Oil is the lifeblood of American industry. Minneapolis-Moline power units equipped with Bendix magnetos are helping materially to maintain a constant supply of this vital commodity. These versatile power units perform a great variety of services at many stages of petroleum production and processing.

The Bendix magneto selected by Minneapolis-Moline for this rugged service is a heavy-duty magneto with high electrical output for medium and large size engines of one, two, four and six cylinders. The magneto is supplied with fixed or variable spark and standard or low fire hazard ventilation. An impulse coupling provides for complete adjustment of lag angle and lug position.

Like all Bendix magnetos, the CBR series gives trouble-free performance for extremely long periods of time. Design simplification eliminates costly service maintenance.

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-pipe with the yearmark!

The production of quality steel pipe is a science in itself. There are no quick tricks, for it is a long way from the mines to your pipe warehouse and each step must be carefully watched and supervised.

Behind the scenes at Wheatland to insure a flow of uniform pipe are the laboratories, the technicians who control heats and temperatures, the mill men and inspectors, who work on scale removal, cutting, threading and the shippers who move your orders in the fastest, most economical way. All of these men trained in their own field work to make Wheatland steel pipe as near perfect for you as possible. On your next order specify Wheatland—and get the most for your steel pipe dollar.

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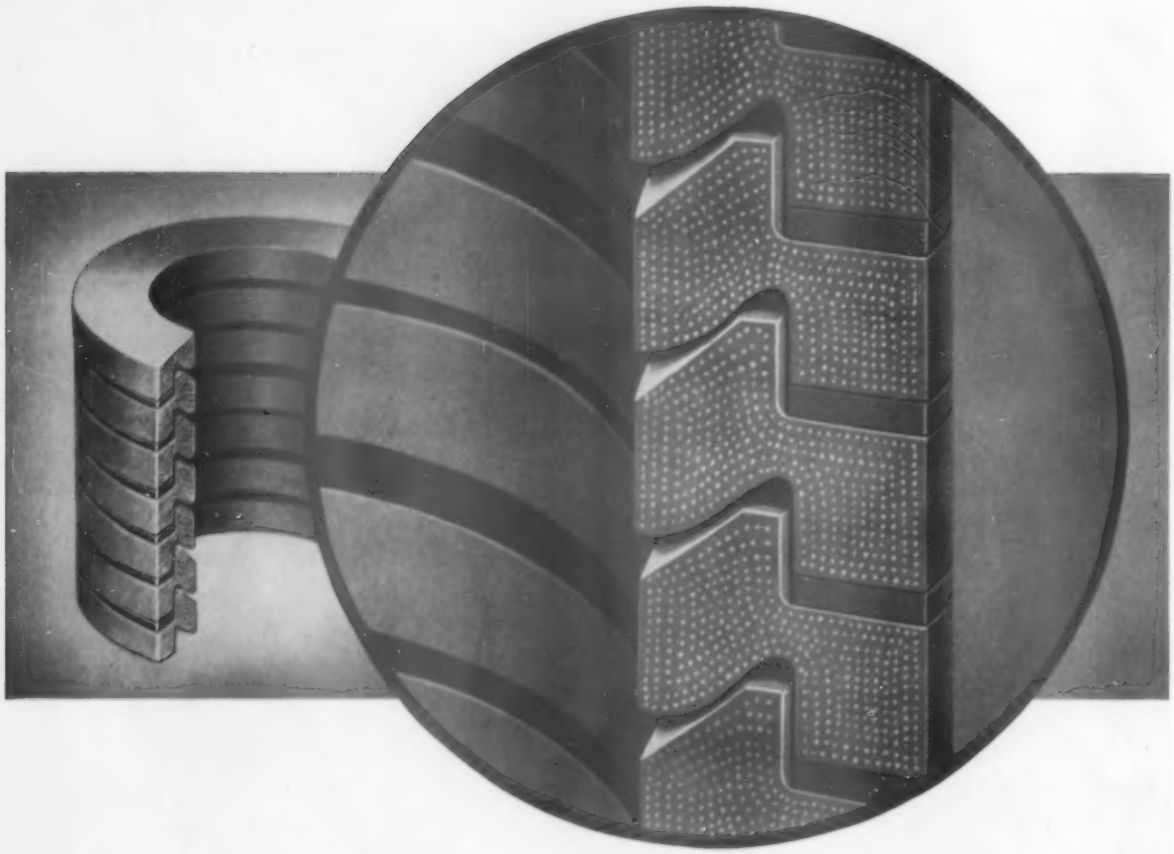

R/M "Vee-Square" mud pump packings need no sensitive gland adjustments

For heavy-duty service in the oil fields, you won't find better packings than R/M "Vee-Square"® Rings. They seal efficiently; are easier on rods; and, unlike ordinary V-ring packings, do not require sensitive, finger-tip adjustment.

Take a look at the cut-away view of their construction. Note the solid square section—it absorbs gland pressure, keeps the packing from rolling and riding the rod. Note the V-design—it assures automatic sealing. Note the soft rubber cushion between the rings—it prevents blow-by and compensates for any overtightening.

R/M MAKES A COMPLETE LINE OF PACKINGS AND GASKETS AND SELLS THEM ONLY THROUGH AUTHORIZED DISTRIBUTORS

R/M PACKINGS
RAYBESTOS-MANHATTAN, INC.
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If lowering your mud pump rod costs interests you, write today for our free bulletin on R/M "Vee-Square" Packing Rings.

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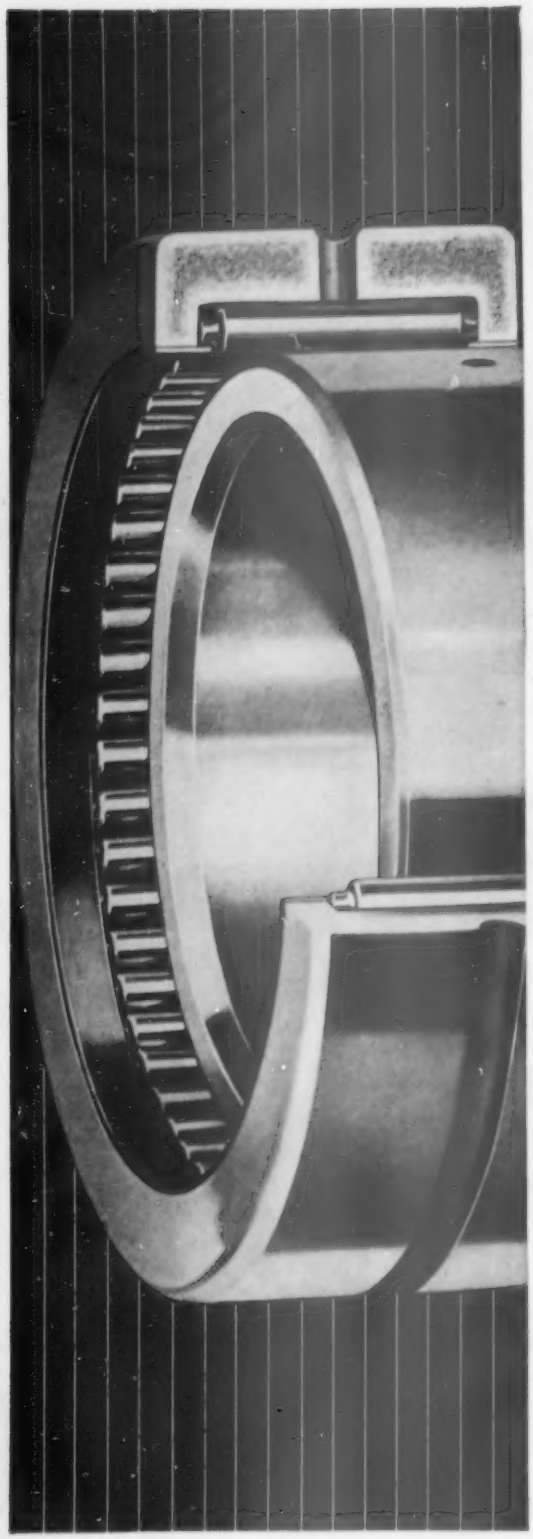
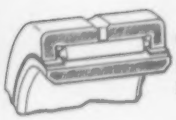
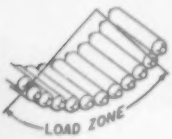


Here's why
TORRINGTON
Heavy Duty Needle Bearings
...give you top value for your bearing dollar



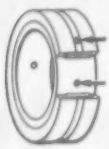
Carburizing grade nickel steel for both inner race and one-piece outer race gives harder, more wear-resistant surfaces, tougher, more shock-resistant cores.

Accurately ground raceway and side flange surfaces are sturdy and eliminate drag at roller contact, keep rollers in true path. No cage required.



Full complement of rollers of precision controlled diameters assures maximum load carrying capacity.

Large roller diameters provide maximum trunnions with large fillets for increased strength—capacity—wear-resistance.



Lubrication groove in outer race, oil holes in both inner and outer races permit easy, effective lubrication to the channel and rolling elements.

Stainless steel retaining bands spot welded into position for positive roller retention. Resist entry of foreign matter. Fragile lips eliminated.

Unit outer race assembly for operation on hardened, ground shaft allows easy installation. Torrington Heavy Duty Needle Bearings are available from stock in a complete range of sizes. Try them—compare them for VALUE!

THE TORRINGTON COMPANY
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Spherical Roller • Tapered Roller • Cylindrical Roller • Needle • Ball • Needle Rollers

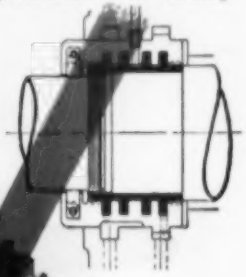
ALLIS-CHALMERS

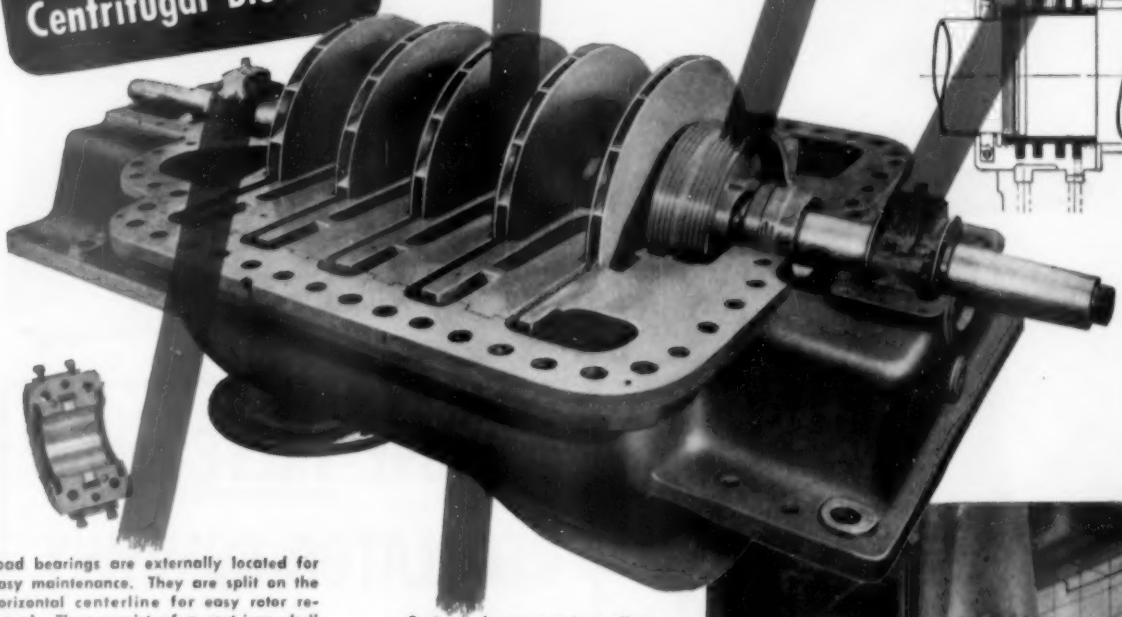
Multi-Stage Centrifugal Blowers

Impeller construction provides unobstructed passage of air or gas. Impellers are furnished in riveted or welded types, as determined by impeller dimension. Note that in riveted impeller wheels, rivets are integral with, and milled from, blade stock.

Impeller wheels are located accurately on shaft with sleeves and are mounted with light shrink fit. Bores are ground to size. Lock nuts prevent axial movement.

Sealing during operation is provided by oil pressure seals. A carbon ring seal prevents leakage when blower is not running.





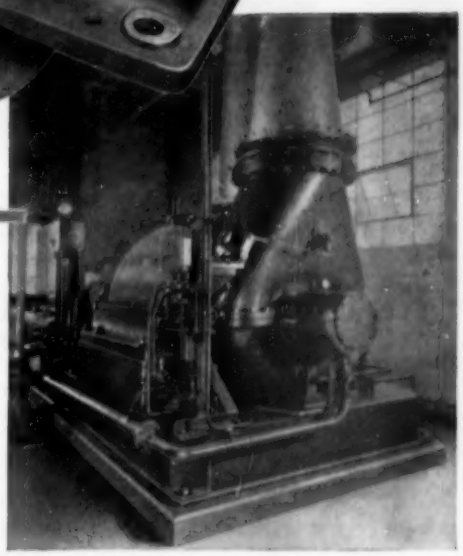
Load bearings are externally located for easy maintenance. They are split on the horizontal centerline for easy rotor removal. They consist of a cast-iron shell with removable, babbit-lined steel inserts.

Casing is heavy cast iron, alloy, or forged steel.

Why these blowers can run for years *without stopping*

The key to "round the clock" performance in fluid catalytic cracking plants is *quality*, as illustrated in the features above.

For highly dependable, low maintenance air and gas handling equipment, as well as motors and control, call your nearby Allis-Chalmers office, or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4465

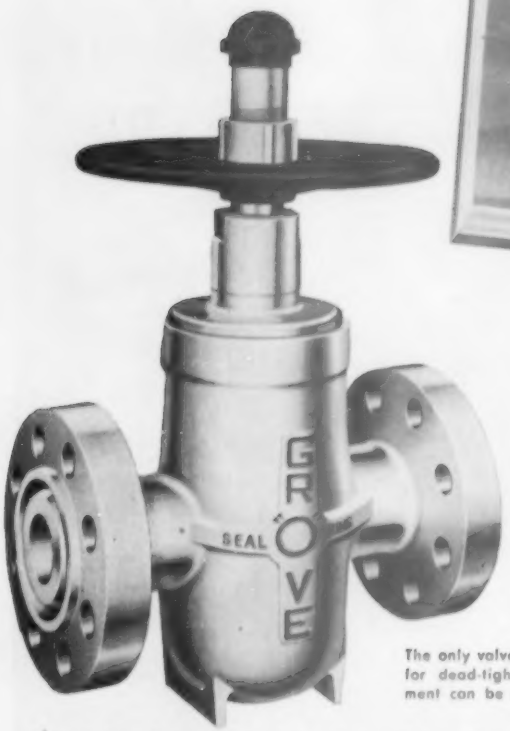


This Allis-Chalmers four-stage centrifugal blower supplies 24,000 cfm to the catalytic cracking tower of an eastern refinery on a 24-hour-a-day basis, month in and month out.

ALLIS-CHALMERS

INDUSTRY ACCEPTANCE

forces a change in our name to . . .



The only valve you can check in the line—anytime for dead-tight shutoff. Freedom of gate movement can be checked without breaking the seal.

GROVE VALVE and REGULATOR COMPANY

Special valves have long been important in Grove engineering and production. But, with the unprecedented acceptance of Grove *standard valve* design and performance—*valves* have become a major factor in the company's operation. Recognition of this importance is now carried in the name GROVE *VALVE* AND REGULATOR COMPANY.

Grove Seal-"O"-Ring Gate Valves, which have been responsible for this expansion, offer the ultimate in dependable valve operation for oil and gas production and pipeline services. Unparalleled ease of operation and positive bubble-tight seal are but two of the salient features that account for widespread interest and adoption of this revolutionary through-conduit gate valve.

With nothing so constant as change, Grove's basic objective to provide better equipment for the oil and gas industry has resulted in this change in our company name.

Available through leading oil field supply houses 406

GROVE SEAL-"O"-RING Gate Valves

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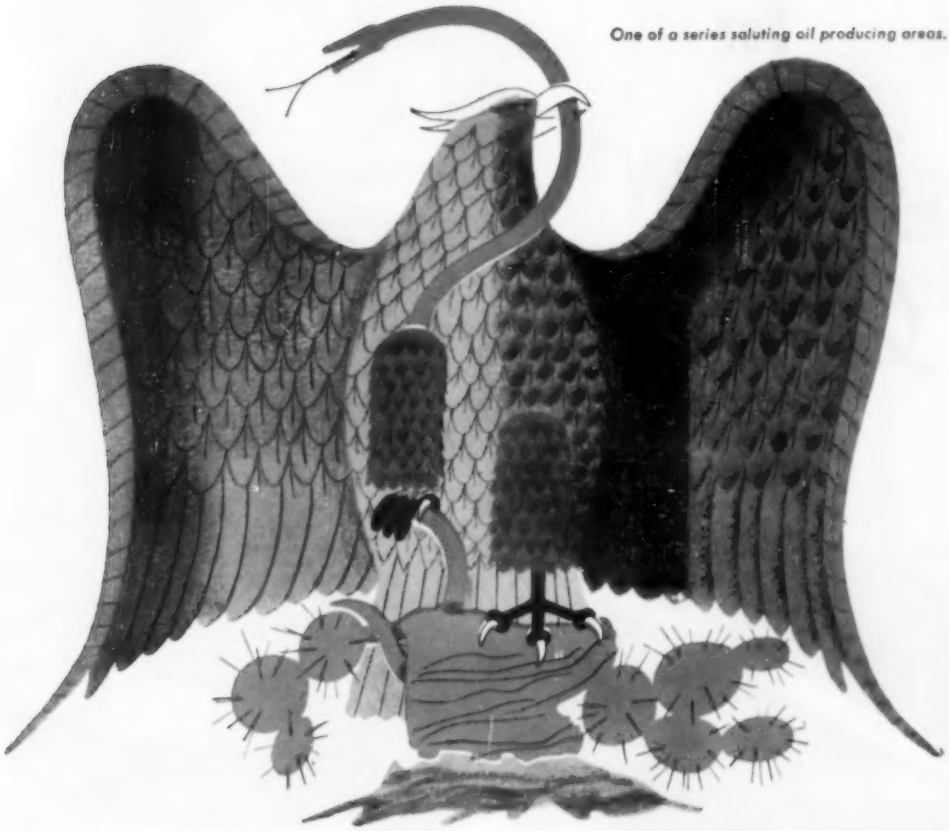
One of a series saluting oil producing areas.



The Eagle . . . symbol of Mexico

. . . symbol of Quality

Just as the eagle is symbolic of Mexico – so is the CP trade mark a symbol of quality. That's why more and more tool pushers, drillers and drilling superintendents in oil producing regions everywhere specify Chicago Pneumatic Three Cone Rock Bits. CP Three Cone Rock Bits are built to take a beating yet afford fast penetrating speeds and deep cutting action in all formations. Available in seven different types, there's a CP bit for every kind of formation – from soft to exceedingly hard and abrasive. For more details write *Chicago Pneumatic Tool Company, Oil Tool Division, 5000 U. S. Highway 81 South, Fort Worth, Texas.*

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For *Long Service* Life

...B&W Carbon Steel Pressure Tubing

The collection of qualities found in B&W Carbon Steel Pressure Tubing, Seamless or Welded, adds up to the all-important end result of long service life.

No less important are the "pre-operating" qualities like uniform ductility, accuracy of dimension and ease of fabrication and installation. Each is a plus that contributes to overall *working* satisfaction from beginning to end use.

Specifically, B&W Carbon Steel Seamless Tubing is available in sizes up to 9⅝ inches outside diameter and B&W Welded is available in sizes up to 4 inches outside diameter. Both in a wide range of wall thicknesses.

As for finishes, seamless is produced either hot-finished or cold-drawn and welded is produced from either hot- or cold-rolled strip.

It meets the applicable specifications of the ASTM, ASME and Government as well as many specifications that may be required for an extraordinary end use.

Where and whenever Seamless or Welded Carbon Pressure Tubing is indicated, make use of B&W's many years in the manufacture of all kinds of tubing. Make *use* of B&W Carbon Steel Pressure Tubing.

B&W SEAMLESS and WELDED TUBES

THE BABCOCK & WILCOX COMPANY
TUBULAR PRODUCTS DIVISION
Beaver Falls, Pa.—Seamless Tubing; Welded Stainless Steel Tubing
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For the complete Carbon Steel Pressure story, write for B&W Bulletin TDC-142. TA-4062(CP)

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you'll save money with a GREEN TRIANGLE ROTARY HOSE

Shutdown time is expensive. The right rotary hose is your best protection against this unnecessary cost.

There's a Green Triangle Rotary Hose for every possible drilling pressure; there's a Continental and New York Belting & Packing Co. Specialist in rotary hose application to help you in the correct selection for your rig.

1. 1-Band: API Class A . . . 3000 lb. test pressure on delivery. Ideal for small rig use at medium or low pressure.
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3. 3-Band: Exceeds API Specification. Built to handle maximum pressure on any job. Combines strength and flexibility for any drilling — anywhere.

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Serving the Oil and Gas Industries

THE CONTINENTAL SUPPLY COMPANY

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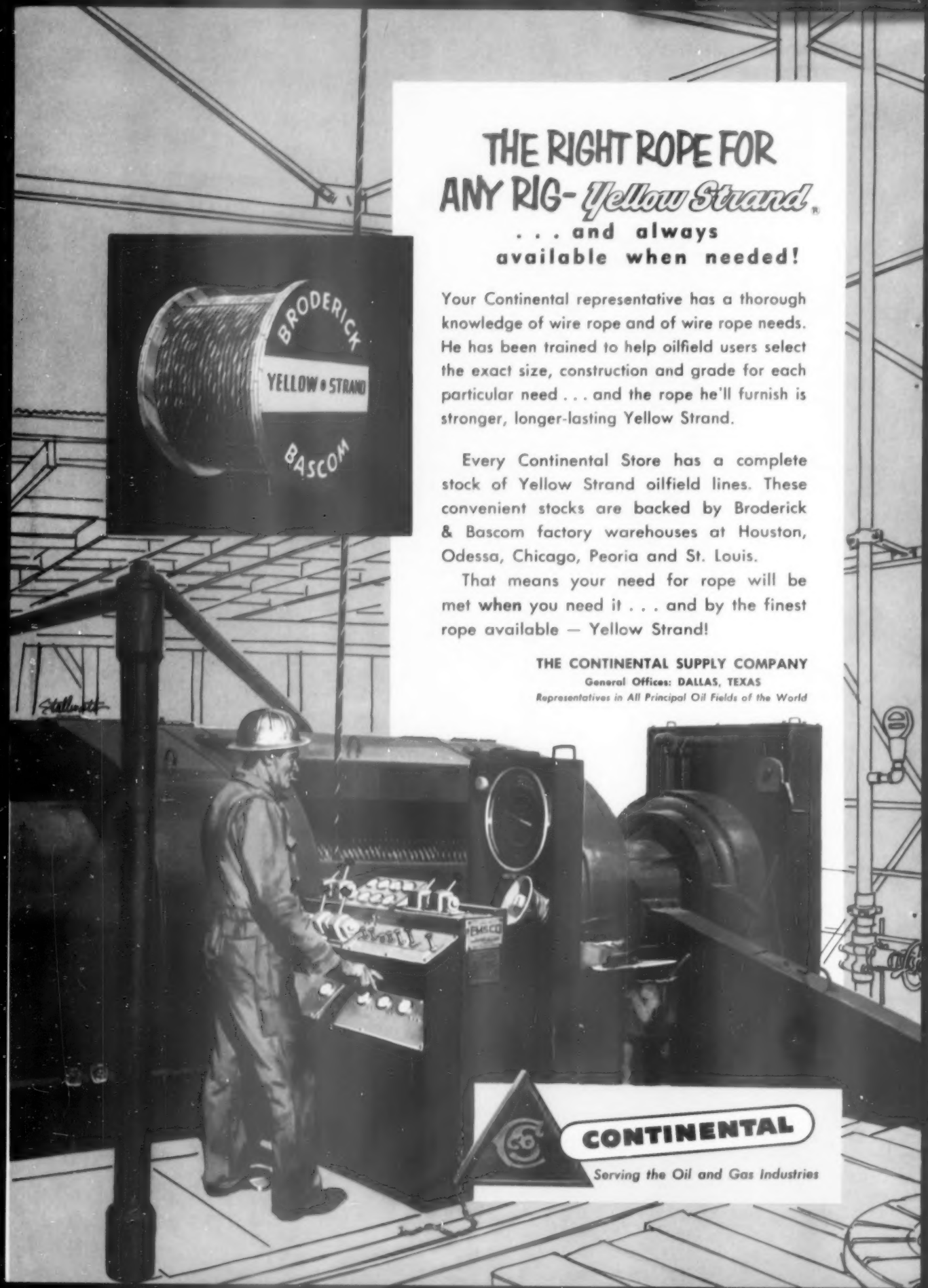
Representatives in All Principal Oil Fields of the World



THE RIGHT ROPE FOR ANY RIG- *Yellow Strand*®

. . . and always available when needed!

Your Continental representative has a thorough knowledge of wire rope and of wire rope needs. He has been trained to help oilfield users select the exact size, construction and grade for each particular need . . . and the rope he'll furnish is stronger, longer-lasting Yellow Strand.

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That means your need for rope will be met **when** you need it . . . and by the finest rope available — Yellow Strand!

THE CONTINENTAL SUPPLY COMPANY
General Offices: DALLAS, TEXAS
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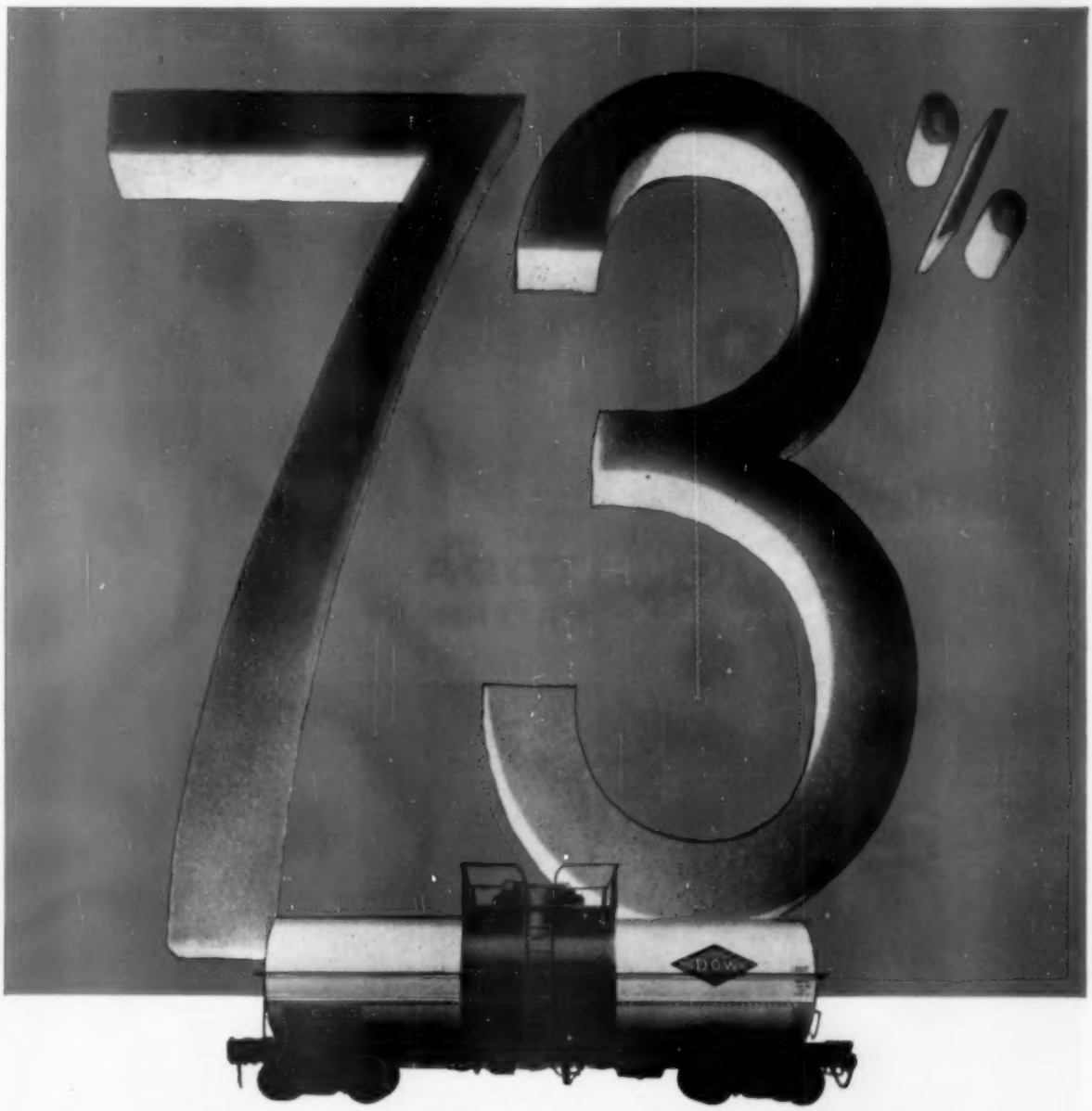
Serving the Oil and Gas Industries



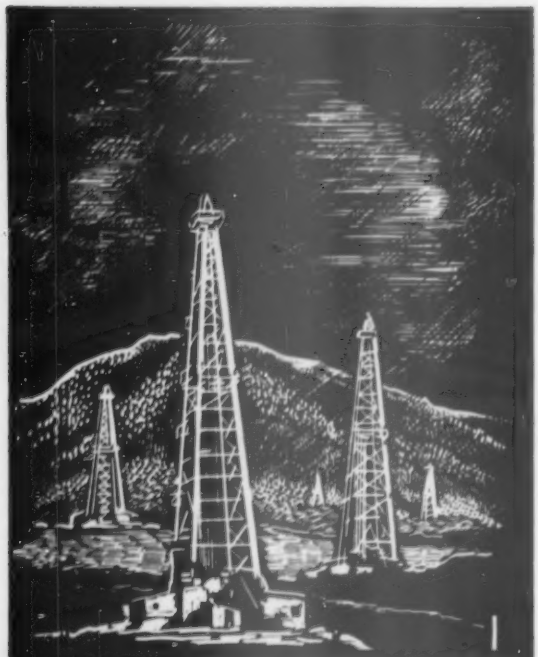
DOW CAUSTIC SODA

Availability of 73% caustic soda solution from Dow is now importantly increased. Two new bulk terminals—at Bayonne, N. J. and North Charleston, S. C.—are speedily serviced by the new liquid chemicals tanker *S. S. Marine Dow-Chem*. These added distribution points, plus expanded 73% production facilities at Midland, Mich. and Freeport, Texas, mean *faster*, more *economical* delivery to the growing number of 73% caustic users.

Our Alkali Sales Department will gladly assist you in accurately figuring your potential *savings* with 73% caustic. THE DOW CHEMICAL COMPANY, Dept. AL 900RC, Midland, Michigan.

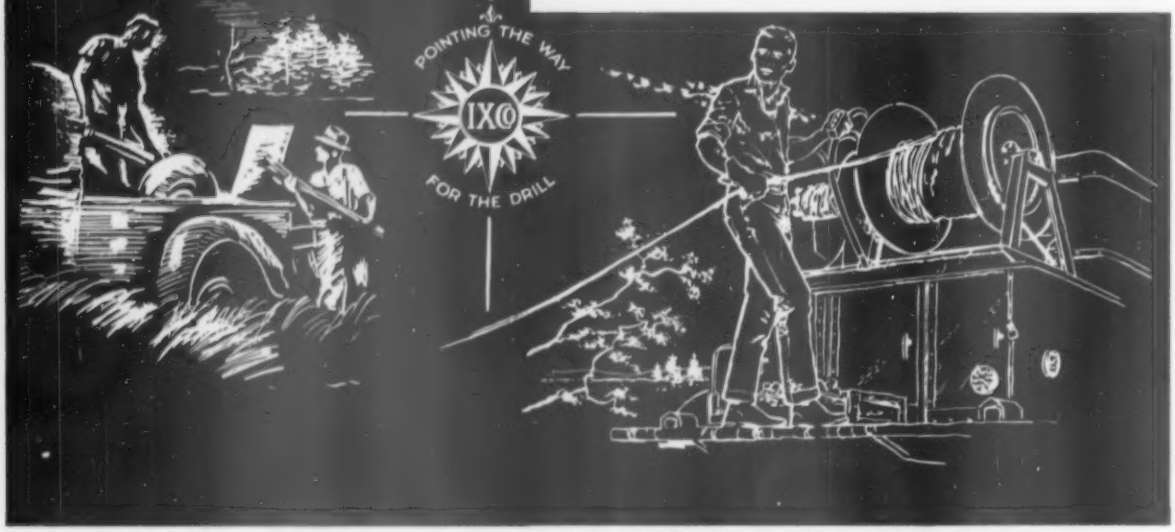
you can depend on DOW CHEMICALS

DOW



S. A. White, Supervisor, is another one of the executives on the IX roster with more than 20 years of geophysical survey experience. Starting with the company in 1933 after attending Texas Christian University, White has worked in every job on a field crew, including helper, shooter, scout, troop leader, and party chief. Men like White are "in charge" on every IX survey.

DERRICKS TODAY
Where I.X. Parties Were Yesterday



IX crews need no constant reminders on the importance of their field work. These crews have seen too many discovery wells brought in . . . entire new fields opened as the result of their geophysical surveys. They know that prior planning and attention to detail will help give an IX client a better "picture" of an area. Consequently, the "know-how" each crew has gained in years of field work pays off in a better survey for you. For a survey you can trust, call on experience — call IX.

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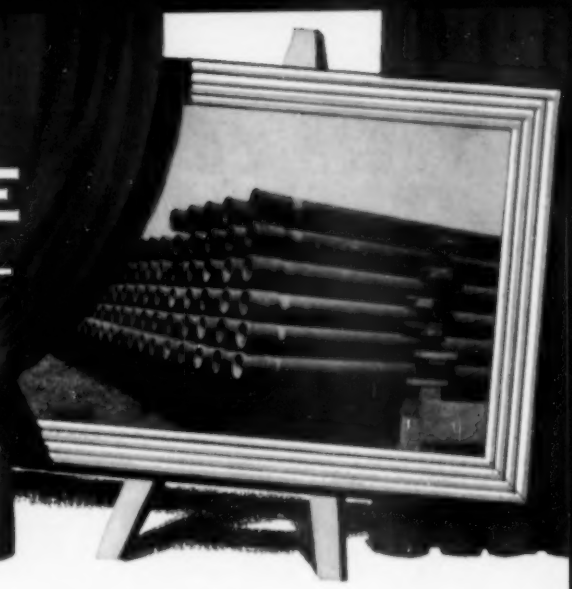
IN THE ART OF STEELMAKING—

NATIONAL SEAMLESS



DEEP well drilling demands the utmost in strength of tubular materials. They must be worked hard, deep—must resist fatigue, twisting action, collapse. And they must always be capable of meeting the higher stresses of tomorrow.

National Seamless Oil Country Tubular Products are acknowledged the world over as the most ideal material for deep well work, from the standpoint of both steel quality and method of manufacture—for, in effect, this very method of manufacture is in itself a severe test of the uniformity and strength of the steel.

Manufacturing a seamless tube by the piercing method is one of the most difficult forging operations in the steel industry. Only steel of the very best forging properties and of high uniformity can be used for the seamless process, since piercing the solid billet tends to search out any defects in the metal. Consequently, as the art of steelmaking has improved, so has the quality of the steel used for NATIONAL seamless. The result—a masterpiece of high strength, high collapse resistance, and maximum security—National Seamless Oil Country Tubular material.

Significant National Tube Developments in the Oil and Gas Industry:

NATIONAL DEOXIDIZED BESSEMER STEEL CASING AND TUBING
Especially well-suited for oil production because of its combination of high yield strength and good ductility.

NATIONAL WARM-WORKED CASING
An extremely high-strength casing possessing a uniformity of physical properties which gives it high collapse resistance and greatly increased joint strength.

NATIONAL DEEP-WELL CASING
A stronger casing than is provided under A.P.I. specifications, to meet constantly increasing depths. Because it is intended for severe service it is hydrostatically tested to 80% of minimum yield strength up to a maximum of 12,000 p.s.i.

NATIONAL (B) BUTTRESS-THREAD CASING

Developed to satisfy the need for a casing joint which will safely and economically support the weight of deep-well casing. The buttress-thread joint is comparable in strength to that of the body of the pipe.

For further information on National Tube developments in the oil industry, write to National Tube Division, United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa.

NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION
PITTSBURGH, PA.
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS NATIONAL SEAMLESS PIPE AND TUBES

UNITED STATES STEEL

Where do *LORAINS* fit on pipelines?

...*EVERYWHERE!*

Before you begin your next pipeline job, see your Thew-Lorain Distributor. He will show you how Lorains can increase the efficiency of every phase of the work . . . whether it is a *hoe* for trenching . . . *clamshell* for digging out cave-ins and to set valves . . . *dragline* for river crossings . . . or *crane* for pipe stringing and handling materials of all kinds. Lorains are loaded with features for pipeline duty such as special, extra-long and extra-wide crawlers to straddle trenches with maximum stability; easy-dumping hoe buckets; tread-travel locks, conveniently and power-operated from the cab; replaceable tread pin bushings; sealed idle rollers; convenient towing hooks. There is no need to shop elsewhere than at your Thew-Lorain Distributor. He has the best machines on crawler or rubber-tires to fit your job . . . everywhere along the line!

THE THEW SHOVEL CO., LORAIN, OHIO

(Above) Williams Brothers, well-known cross-country pipeliners, take advantage of speed and mobility of the newest rubber-tire Lorain, a Moto-Crane, model MC-104, to unload pipe from a barge, and then move to the right-of-way for pipe stringing.

(Below) Two Lorain "TL" Hoes, on extra-wide crawlers, easily straddle this trench to rip through hard shale and rock on this tough digging job in the Southwest.

LORAINS SERVE ALL PHASES OF THE OILFIELD INDUSTRY

Pipeline work is but one of the fields that Lorains fit to a "T". Because the Lorain line is so complete, it can serve all phases of the petroleum industry. There are Lorains on rubber for mobile work around the refinery, Lorains on crawler mountings to meet any terrain conditions. Crane capacities from 6 to 61 tons — shovel-dragline-clamshell capacities up to the 2 yd. class for any excavation or material handling duty.

THEW LORAIN

Why this special oil field jack will give longer trouble-free service

the Roustabout "1523"

When Duff-Norton engineers set out to design safer, longer-lasting jacks for men who work in the oil fields, they discovered one startling fact—about 90% of jack maintenance was in replacing worn springs in the mechanism that controls the jack's raising or lowering action. Result? The Duff-Norton Roustabout "1523" oil field jack is equipped with a patented*, adjustable spring mechanism which assures positive engagement of rack teeth. The spring's tension can be easily adjusted with a screw driver without removing any part of the jack. Should the spring eventually lose its resiliency, there's no need to send the jack to a repair shop. A new, complete spring mechanism assembly can be quickly installed by anyone in a matter of minutes right in the field, making the jack as good as new!

Complete with detachable steel chain, this versatile jack can be operated at any angle at its full 15-ton capacity. Ask your supply store salesman for the Duff-Norton Roustabout "1523." He has it in stock or can get it for you quickly. For complete specifications on this and other dependable Duff-Norton jacks, write the world's oldest and largest manufacturers of lifting jacks for special Oil Field Jack Bulletin AD19B, The Duff-Norton Manufacturing Co., P. O. Box 1889, Pittsburgh 30, Pa. Canadian Plant—Toronto 6, Ontario.

"Giving Industry A Lift Since 1883"

DUFF-NORTON *Jacks*

Here's Why...

WECO UNIONS have so *Many* OUTSTANDING FEATURES

Originators of Acme Thread Wing Unions for the Oil Industry, WECO has consistently put the finest engineering skill into their design and the most advanced manufacturing facilities and craftsmanship into their production.

The ball and cone seat is unexcelled for perfect, positive leak-proof seating.

Extra heavy sub-end wall sections give extra strength where it's needed most.

Precision machined pipe threads mean positive, leak-proof connection.

Wing Nuts are stronger, tougher, to withstand severest service.

Acme Threads are skillfully machined for uniformity, smoothness and strength.

These and other advanced features of WECO Unions are the result of constantly searching for improvements in design and manufacturing processes . . . the reason you can trust WECO Unions for sealing and service.

PESA

- PRESSURES 1000 to 15,000 lbs. SIZES 1" through 12".

It's wise to standardize with.. **WECO**

WECO

WELL EQUIPMENT MFG. CORP. • Division of Chiksan Company • HOUSTON 1, TEXAS

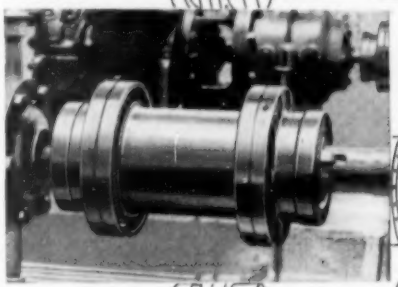
See why
FAST'S Couplings
are your wisest buy

LESS DOWN-TIME. Industry finds that Fast's Couplings, the original gear type coupling, give trouble-free performance. They save on maintenance. Save money (often thousands of dollars in production losses) year in, year out, because there is no down-time due to breakage . . . no expense of replacing perishable parts.

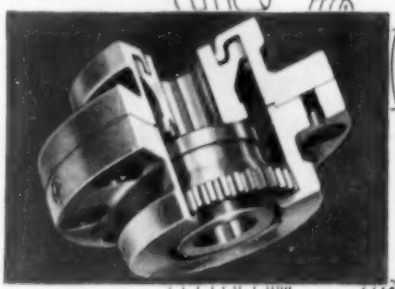
LOWEST COST PER YEAR because Fast's Couplings usually outlast the equipment they connect. Many Fast's Couplings are still in use after 30 years. Why? Because they are ruggedly constructed of the sturdiest, most practical materials . . . all steel in construction, unique in design.

FREE ENGINEERING SERVICE. The same "Know-how" that goes into the manufacture of famous Fast's Couplings . . . that has resulted in over three-fourths of a million successful installations . . . applies to its extensive engineering service. 35 years of experience in developing the most satisfactory materials and designs, means our staff is well prepared to give you the most effective and cost-saving solutions to your coupling problems. Just outline and send them to Koppers for assistance. And send for free catalog. Just mail the coupon below.

Fast's Coupling in a modern petroleum installation.



Close-up of Fast's Coupling . . . ideal in petroleum industry.



Cutaway view of typical Fast's Coupling. Note unique design.

THE ORIGINAL

FAST'S Couplings

KOPPERS

METAL PRODUCTS DIVISION • KOPPERS COMPANY, INC. • BALTIMORE, MD. This Koppers Division also supplies industry with American Hammered Industrial Piston and Sealing Rings, Koppers Electrostatic Precipitators, Aeromaster Fans and Gas Apparatus.
Engineered Products Sold with *Service*

KOPPERS COMPANY, INC., *Fast's Coupling Dept.*, 380 Scott St., Baltimore 3, Md.

Gentlemen: Send me a Free, Fast's Catalog giving detailed descriptions, engineering drawings, capacity tables and photographs.

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Company .....

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HUSKY'S RESULTS

The Charge		The Product	
API	52.6	API	52.6
Sulfur %	0.1	Sulfur %	0.001
RVP	6.1	RVP	12.0
ASTM Over	95	ASTM Over	87
End Pt.	370	End Pt.	385
CFRR Octane Clear	54.0	CFRR Octane Clear	80.6
		3cc	94.6
		C4 Plus Yield, Vol. %	95.5

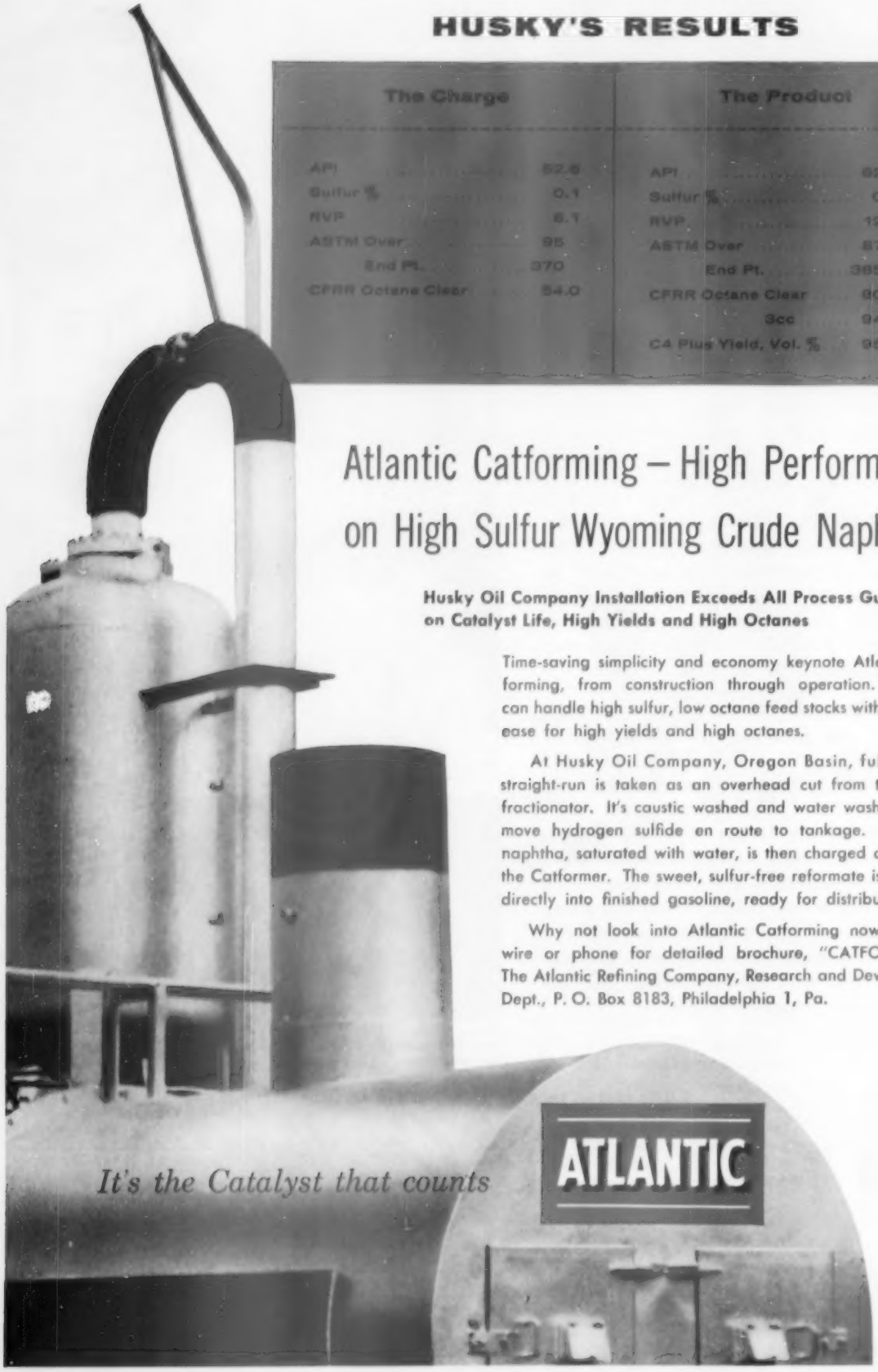
Atlantic Catforming – High Performance on High Sulfur Wyoming Crude Naphthas

Husky Oil Company Installation Exceeds All Process Guarantees on Catalyst Life, High Yields and High Octanes

Time-saving simplicity and economy keynote Atlantic Catforming, from construction through operation. Refiners can handle high sulfur, low octane feed stocks with one-step ease for high yields and high octanes.

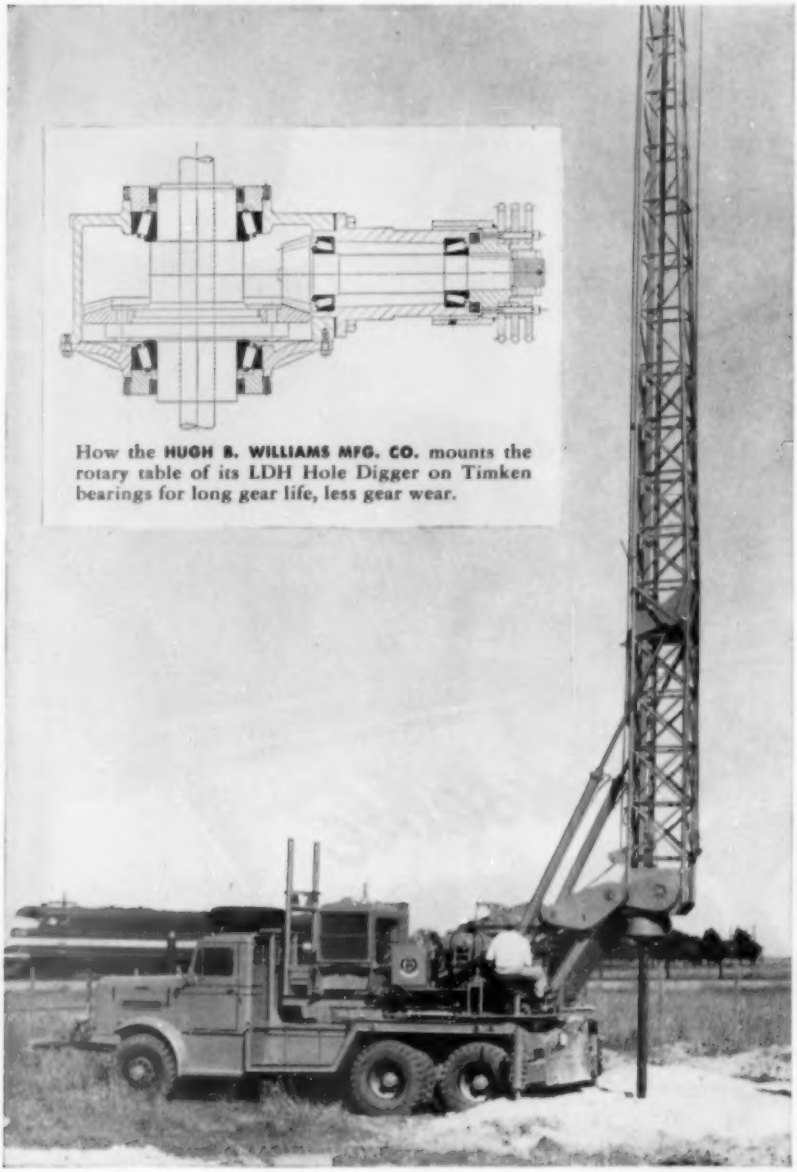
At Husky Oil Company, Oregon Basin, full-boiling straight-run is taken as an overhead cut from the crude fractionator. It's caustic washed and water washed to remove hydrogen sulfide en route to tankage. This raw naphtha, saturated with water, is then charged directly to the Catformer. The sweet, sulfur-free reformate is blended directly into finished gasoline, ready for distribution.

Why not look into Atlantic Catforming now? Write, wire or phone for detailed brochure, "CATFORMING." The Atlantic Refining Company, Research and Development Dept., P. O. Box 8183, Philadelphia 1, Pa.



Digs 8 ft. diameter holes 45 ft. deep

...with TIMKEN® bearings taking heavy driving loads



How the **HUGH B. WILLIAMS MFG. CO.** mounts the rotary table of its LDH Hole Digger on Timken bearings for long gear life, less gear wear.

UNDER the right conditions this mighty Williams hole digger drills an 8-foot diameter hole 45 feet into the ground! That puts heavy loads on the driving gears in the rotary table so Williams mounts the gear shafts on Timken® tapered roller bearings.

Timken bearings take the heavy stresses because they carry the load on full *lines* of contact between rollers and races which gives them high load-carrying capacity.

But that's not all. The gears in the digger are *bevel* gears and consequently they exert strong *thrust* as well as radial loads. However, the taper of Timken bearings enables them to take any combination of radial and thrust loads. No extra thrust devices are needed. Timken bearings keep the gears in accurate alignment. This means less gear wear, longer gear life.

Timken bearings make all kinds of equipment run better and last longer. They reduce friction to a minimum, the result of correct geometric design and extremely accurate manufacture. And to get the best steel for Timken bearings, we make our own, the only U. S. bearing manufacturer that does. Always look for the trade-mark "Timken". The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.

TIMKEN

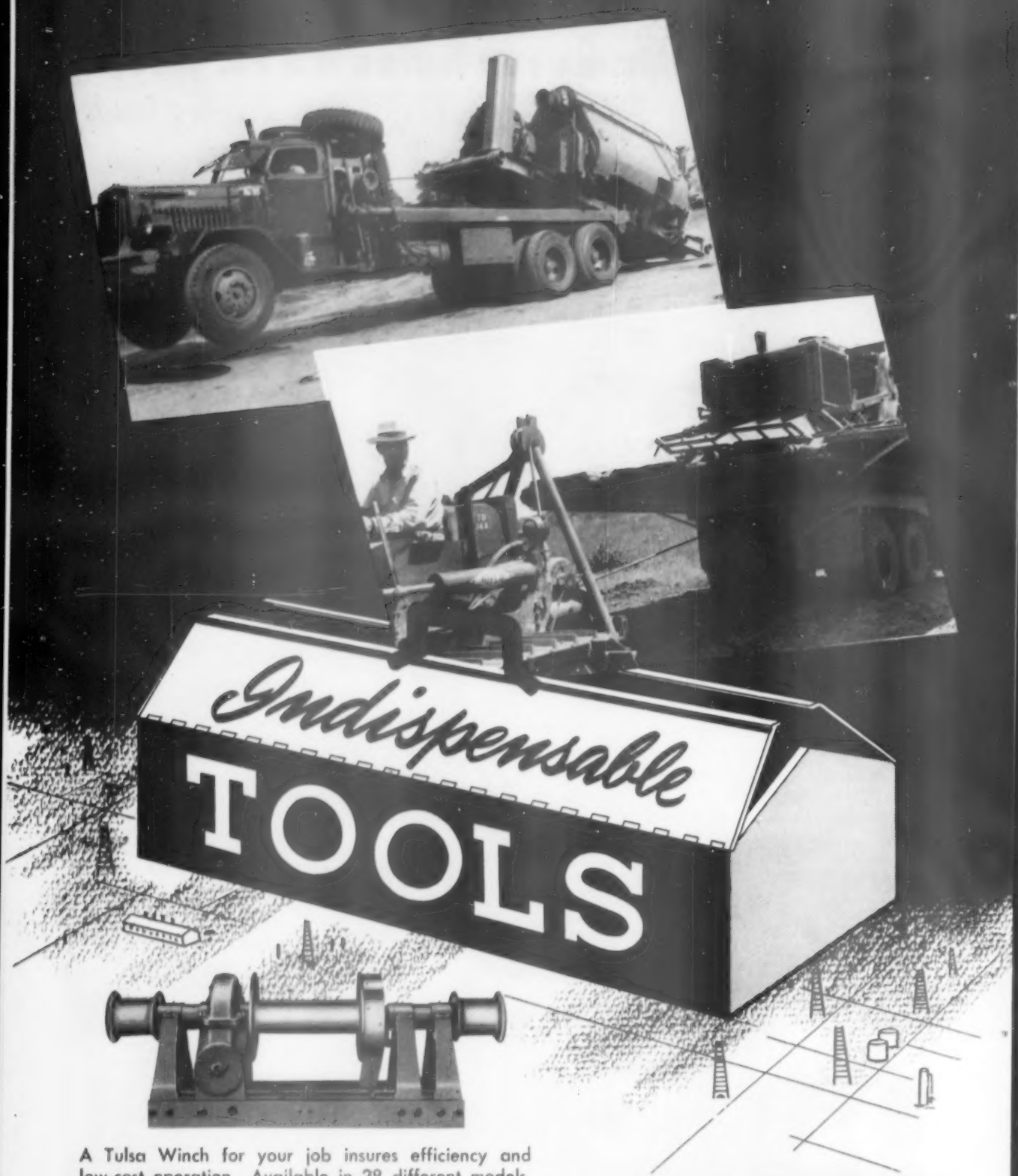
TAPERED ROLLER BEARINGS

DESIGN LEADERSHIP

The first Timken tapered roller bearing was produced in 1898. Since then the one-piece multiple perforated cage, wide area contact between roller ends and ribs, and every other important tapered roller bearing improvement have been introduced by The Timken Roller Bearing Company.

The Timken Company leads in: 1. advanced design; 2. precision manufacture; 3. rigid quality control; 4. special analysis steels.

NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▱ BEARING TAKES RADIAL ◫ AND THRUST ⊟ LOADS OR ANY COMBINATION ✳



A Tulsa Winch for your job insures efficiency and low-cost operation. Available in 28 different models, in capacities from 6,000 to 80,000 pounds, there is a Tulsa Winch to meet every winching requirement.

For detailed information and prices, contact your nearest Tulsa Winch distributor or write direct to —

Tulsa* Winch
TULSA, OKLAHOMA
A DIVISION OF VICKERS INC.

*Reg. U. S. Pat. Off.

THE WORLD'S LARGEST MANUFACTURER OF TRUCK POWER WINCHES

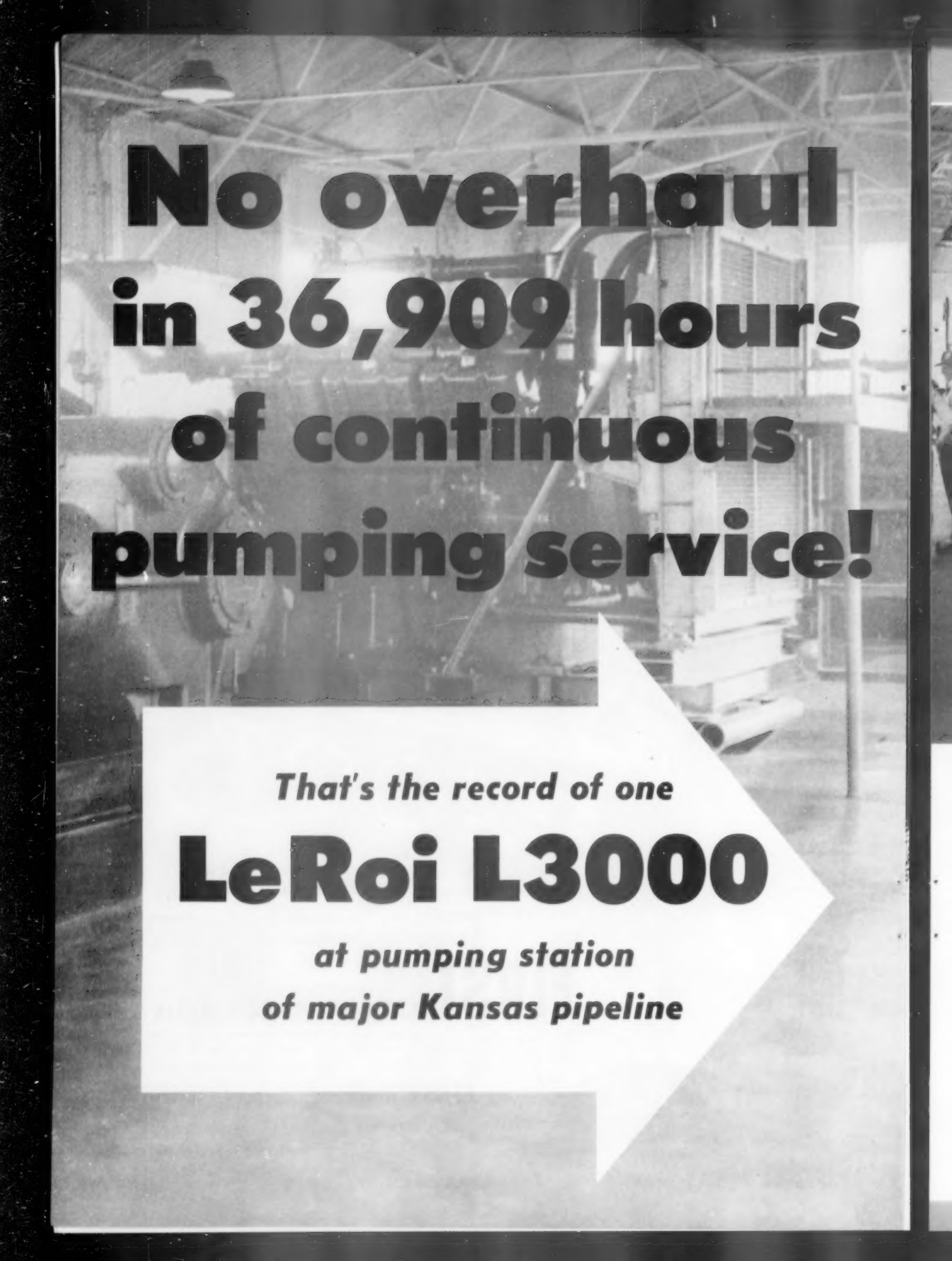
FIRST *to help put the future in East Texas oil production...*

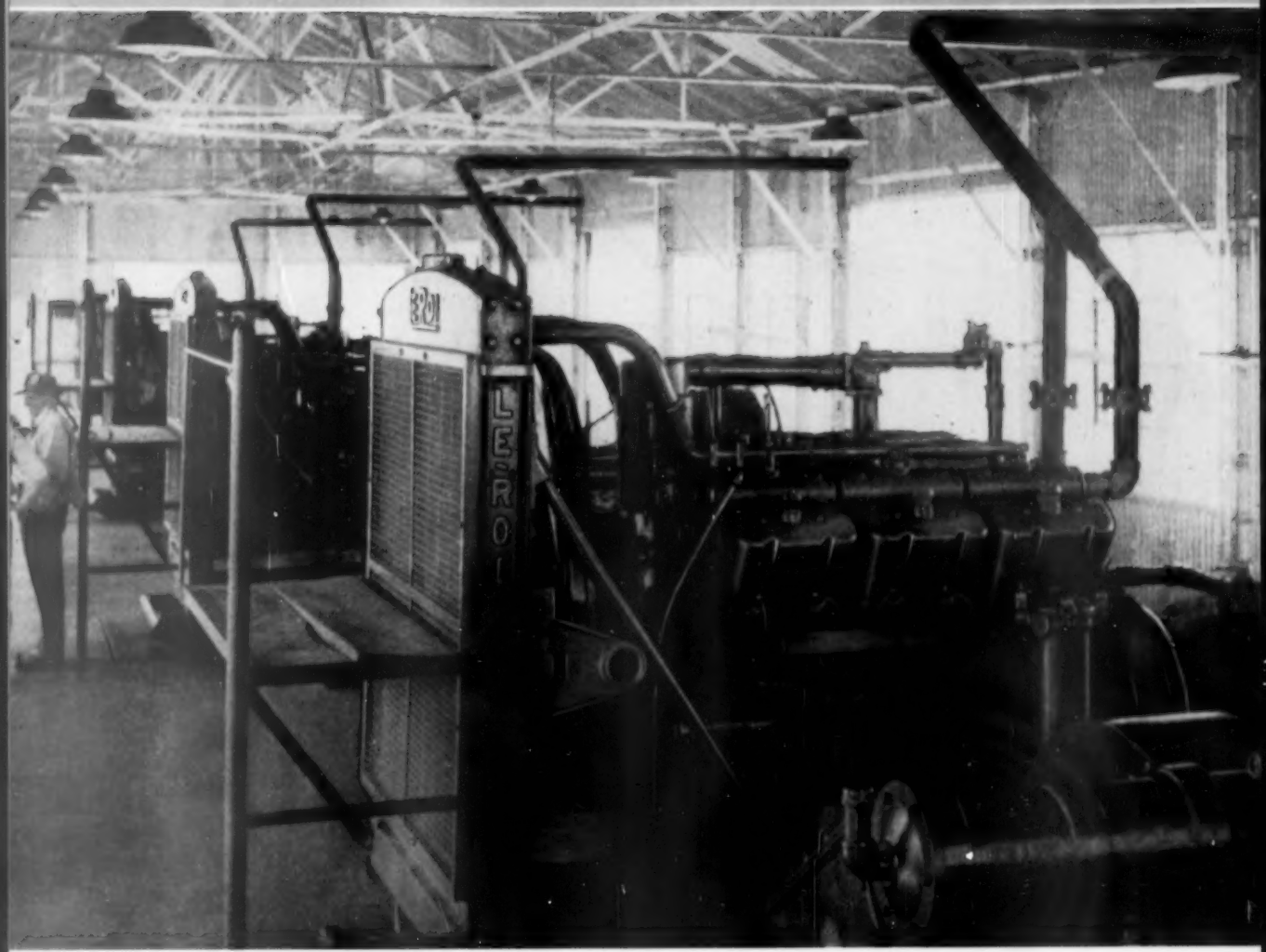
Back in the early '30s, when the East Texas oil field was "wide open," the oil industry faced a major problem of price deflation. Through the guidance of the First National Bank in Dallas, proration problems were licked and prices were stabilized. Pioneering a new concept of financing for independent producers, the First provided a new method of making oil loans by helping to establish oil in the ground as a bankable commodity.

FIRST NATIONAL BANK in Dallas

Member Federal Deposit Insurance Corporation

put FIRST financing in your own oil future


No overhaul
in 36,909 hours
of continuous
pumping service!
That's the record of one
LeRoi L3000
at pumping station
of major Kansas pipeline



The figures speak for themselves...

Le Roi leads in dependability! Le Roi leads in economy!

If you're interested in cutting your costs for pipeline pumping, here are figures you simply can't afford to ignore:

In the installation pictured above, one of the Le Roi L3000's operated continuously for more than 4 years — under an average load of about 200 hp — before needing overhauling! And then labor amounted to only $373 and parts to only $1578.

A second Le Roi L3000 at the same station operated continuously for 33,615 hours — under the same load — before it had to be overhauled! Labor for the overhaul cost only $476 and parts only 130.

Now, these aren't isolated cases. In fact, another Le Roi L3000 installed at a different pumping station of this same pipeline company had over 39,500 hours' service and had never been overhauled!

Want to see profitable performance like that at first hand? Ask your supply house or Le Roi distributor to take you around to some Le Roi installations. Have them show you why more and more Le Roi's are being installed for pipeline and other oil-field service.

LE ROI COMPANY

A Subsidiary of Westinghouse Air Brake Co.

MILWAUKEE 14, WISCONSIN

Plants: Milwaukee • Cleveland • Greenwich, Ohio

Oil Field Headquarters: Tulsa Oklahoma

Service as Near as Your Telephone

Complete parts stocks . . .
Skilled mechanics on 24-hour call
. . . Unexcelled overhaul facilities

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Carson Machine & Supply Co.—Oklahoma City.

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Southern Engine and Pump Company—Houston Kilgore, Edinburg, Dallas, San Antonio, Corpus Christi, Texas, and Lafayette, Houma, New Orleans, Louisiana.

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General Machine & Supply Co.—Odessa, Snyder, Texas.
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Carson Machine and Supply Co.—Great Bend.

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Ingersoll Corporation—Shreveport, Louisiana, El Dorado, Arkansas, and Clarksdale, Jackson, Mississippi.

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Le Roi Engine Sales Co.—Long Beach, Calif.

Appalachian Area
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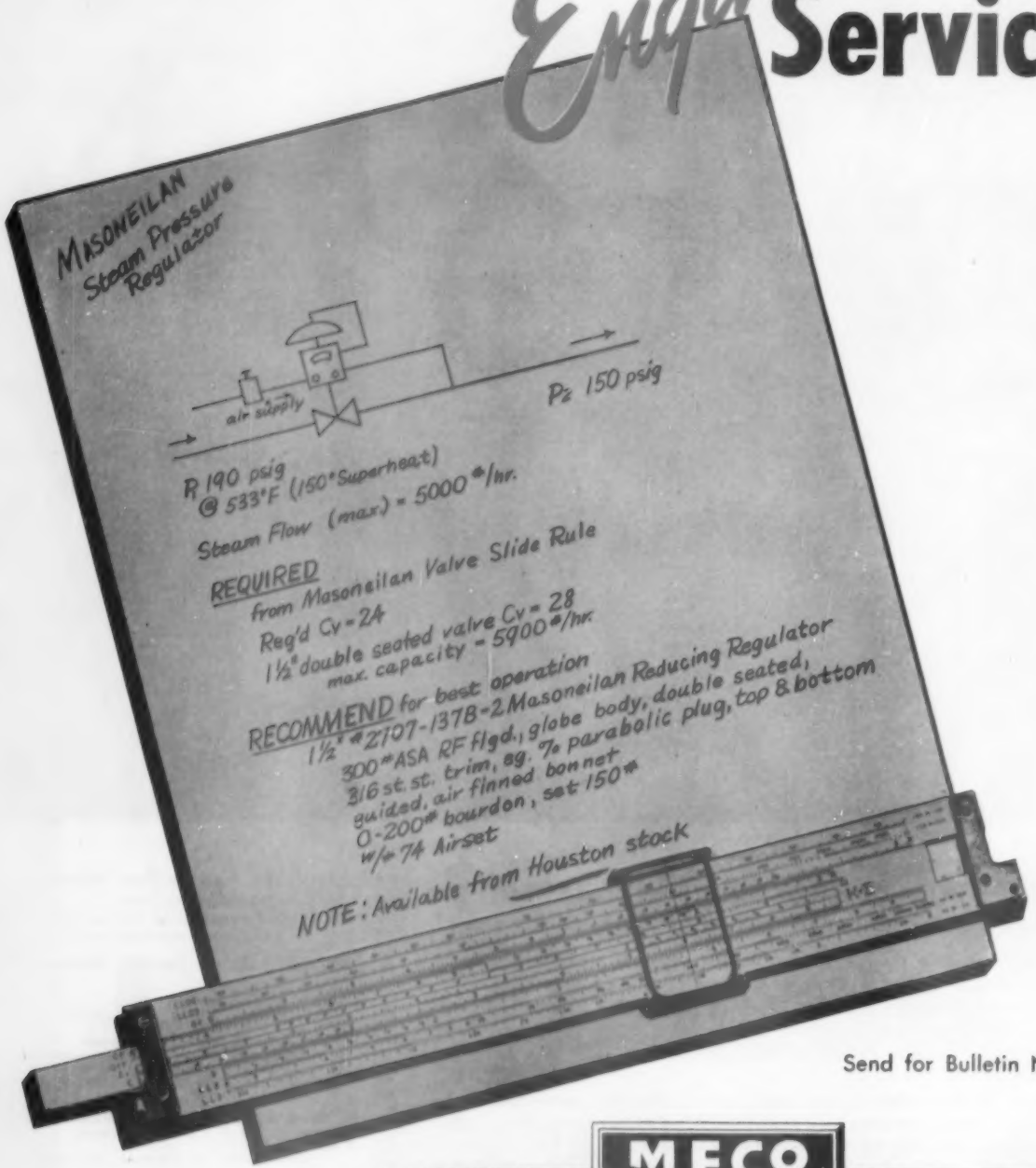
Equipment with *Engineering* Service


MASONEILAN
Steam Pressure
Regulator
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P2 150 psig
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@ 533°F (150° Superheat)
Steam Flow (max) = 5000 #/hr.
REQUIRED
from Masoneilan Valve Slide Rule
Reg'd Cv = 24
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max. capacity = 5900 #/hr.
RECOMMEND for best operation
1½" # 2707-1378-2 Masoneilan Reducing Regulator
300# ASA RF flgd., globe body, double seated,
316 st. st. trim, eg. % parabolic plug, top & bottom
guided, air finned bonnet
0-200# bourdon, set 150#
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NOTE: Available from Houston stock

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WRITE OR PHONE US YOUR PROBLEM

Butyrate means pipe that is lightweight

Tenite Butyrate's light weight speeds installation. Three men can lay 4,000 feet of 4" Tenite pipe in a day. Eight men usually are needed to handle the same amount of metal pipe.

Butyrate means pipe that resists corrosion

You can bury Tenite Butyrate pipe and never worry about corrosion failures. Tenite resists corrosion by sour crudes, salt water and electrolytic soils.

Butyrate means pipe that resists paraffin clogging

You can prove to yourself that the smooth wall of Tenite Butyrate pipe offers no toe holds for paraffin. Install a test section like this in your present metal line.

What could Tenite Butyrate mean to you?

TENITE BUTYRATE PIPE means different things to different users. To a man troubled by corrosion, Tenite means pipe that resists the corrosive conditions found in oil fields. To a man pumping high-paraffin crude, Tenite means relief from the frequent cleaning of paraffin-plugged lines. To a man laying a long string, Tenite means a lightweight pipe —easy to handle, simple to join. Tenite means other things, too . . . greater flow with less load on pumps, good impact resistance, flexibility to follow the contours of the earth, less year-'round maintenance.

Tenite Butyrate can promise long, trouble-free service for your crude, brine and water disposal lines. Get the facts on Tenite. Learn how, in field after field, Tenite pipe has proved its practical value. Mail the coupon for more information and a list of Tenite pipe suppliers. EASTMAN CHEMICAL PRODUCTS, INC., Kingsport, Tennessee, subsidiary of Eastman Kodak Company.

TENITE

BUTYRATE

an Eastman plastic

EASTMAN CHEMICAL PRODUCTS, INC.

KINGSPORT, TENNESSEE

Please send me information on TENITE BUTYRATE PIPE and a list of companies manufacturing Tenite pipe and fittings.

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POSITION .....

COMPANY .....

STREET .....

CITY ..... STATE .....

OG-1054

From Pioneer Cut to Leveled Well Site...

ALLIS-CHALMERS
Earth-Moving Equipment
sees you through...

Allis-Chalmers provides oil field users with today's most advanced design earth-moving and materials handling equipment. Here is the complete line-up that is helping to cut costs and speed production on a wide variety of construction and maintenance operations.

Crawler Tractors — Allis-Chalmers builds four sizes of heavy-duty diesel tractors: HD-5, 11,250 lb, 40 drawbar hp; HD-9, 18,800 lb, 72 drawbar hp; HD-15, 27,850 lb, 109 drawbar hp (hydraulic torque converter drive optional); HD-20, 41,000 lb, 175 net engine hp, hydraulic torque converter drive. With cable or hydraulic bulldozer blades they build access roads . . . dig slush pits, level drill sites . . . mound up fire walls. With winch they skid drill rigs, they give supply trucks a lift, uproot stumps, haul casings up to drill rigs, etc.

Motor Graders — Allis-Chalmers offers three diesel-powered models — 19,220 lb to 23,000 lb, 78 to 104 brake horsepower — and the outstanding leader in its size class, the 50-hp, gasoline-powered Model D. This machine offers such big-grader advantages as tandem drive, single member tubular frame, the famous ROLL-AWAY moldboard. Leaning front wheels and power circle turn optional. The Model D builds and maintains access roads, drainage ditches, parking lots, yards . . . grades around wells, tanks, pumps . . . scarifies toughest surfaces. With rear-end loader it stockpiles and loads material.

Wheel Tractors — Model IB for fast, economical mowing, sweeping, snowplowing and countless pulling and pushing jobs around tank farms, refineries, supply yards, loading docks and other buildings. Provides 18 drawbar hp, 22.8 belt hp; available with rear power take-off and belt pulley, other attachments. Model IB is built low and has a strong mounting frame for attaching auxiliary equipment.

Tractor Shovels are available for all four sizes of Allis-Chalmers tractors. Standard bucket sizes range from one to four cubic yards — light material, up to seven cubic yards. These hydraulically controlled machines handle dirt, crushed stone or gravel for roads, move bulk material . . . clean up around wells, pumping stations, tank farms . . . load snow.

Allied Equipment — Complete line of bulldozers, hydraulic or cable, straight or angle types. Also the frame-mounted, highway width 9X and 15X dozers tailored especially for oil field use — great for slush pit digging. Side booms for HD-9, HD-15 and HD-20 Tractors. When equipped with crane hook, side boom handles pipe, miscellaneous supplies.

• • •

Contact your Allis-Chalmers dealer for full details. He will be happy to demonstrate this earth-moving and material handling equipment on your own job.

ROLL-AWAY is an Allis-Chalmers trademark.

ALLIS-CHALMERS
TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

Engines for powering pumps, winches, welders, drills, compressors, generators, pipe cleaners and straighteners, elevators and hoists, all kinds of oil field servicing equipment. Heavy-duty in every respect, these engines stand up on toughest going. Slow speed, high torque — hang on to overloads. Operate on gasoline, low-grade fuel, distillate, butane, natural gas. Three sizes — from 87.1 to 400 ft lb torque. Available through Fred E. Cooper Inc., Allis-Chalmers power unit distributor to the oil industry.

AGAIN and AGAIN

Wide Preference for

DIAMOND ROLLER CHAINS

Shot-Peening Since 1944

To increase the fatigue resistance of Diamond Chains, link plates have been specially processed, and chain rollers and other parts have been shot-peened since 1944.

Patented BCL Connector

The patented, bushed-centered-plate BCL connector for multiple-strand press-fit center-plate chain has simplified connecting and disconnecting, and assures full value in Diamond Chains at the connecting links.

Press-Fit Center-Plate Construction of Multiple-Strand Roller Chain

Diamond's press-fit center-plate construction of multiple-strand chains provides equal distribution of loading across the chain width—throughout the entire, longer service life. Also available with slip-fit Center Plate Construction for Supply Store Replacement Stocks.

Rigidity of Link Construction

Special finishing of link plate pitch holes, providing 100% contact of pins and bushings in their respective link plates, considerably enhances the uniform and substantial press-fitting of these parts, assuring maximum rigidity of link construction.

ON THE WORLD'S FOREMOST OIL FIELD EQUIPMENT

DRILLING • PUMPING • SERVICING RIGS

• The long-life performance, the extra reserve strength—the uniformity of high quality in every foot of Diamond Roller Chain have resulted in their wide preference by the recognized leading manufacturers of oil country equipment.

Experienced production men operating these rigs all over the world have proof again and again that there is no substitute for Diamond quality and dependability.

DIAMOND CHAIN COMPANY, INC.

Where High Quality is Traditional

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Please refer to the classified section of your local telephone directory under the heading CHAINS or CHAINS-ROLLER

DIAMOND ROLLER CHAINS

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THE INSIDE REASONS FOR MACK'S STAND-OUT $$$ EARNING POWER

Keeping going under conditions that stop other trucks cold—carrying big payloads . . . on fast schedules . . . in the roughest operations—that's what points up the ability of Mack trucks to build greater profits for you.

WHEREVER YOU SEE A TOUGH JOB . . .
THERE IS WHERE YOU SEE MACKS

Mack TRUCKS

Mack Trucks, Empire State Building, New York 1, N.Y. Factory Branches and distributors in all principal cities for service and parts. In Canada: Mack Trucks of Canada, Ltd.

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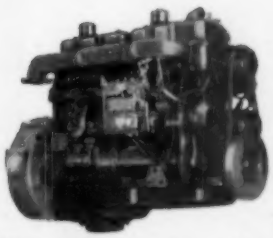
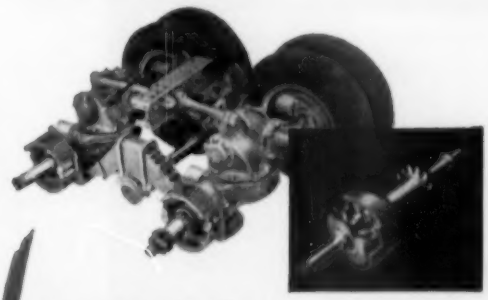
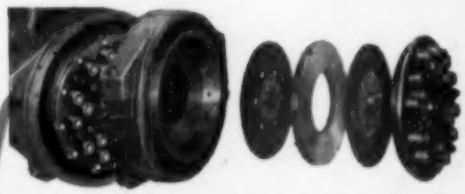


Plentiful Horsepower. Mack provides the right powerplant, gasoline or diesel, to haul most efficiently, most profitably for each specific operation. Complete range of engine options up to 400 horsepower. Coupled with the most rugged transmission or torque converters yet developed.

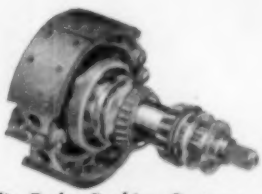


Balanced Bogie With Power-Divider. Only Mack six-wheelers offer the unique advantage of Mack's Balanced Bogie, incorporating the exclusive Power-Divider. With the Mack Power-Divider torque is distributed between bogie axles in proportion to traction, thus enabling Macks to pull through where other trucks mire in.

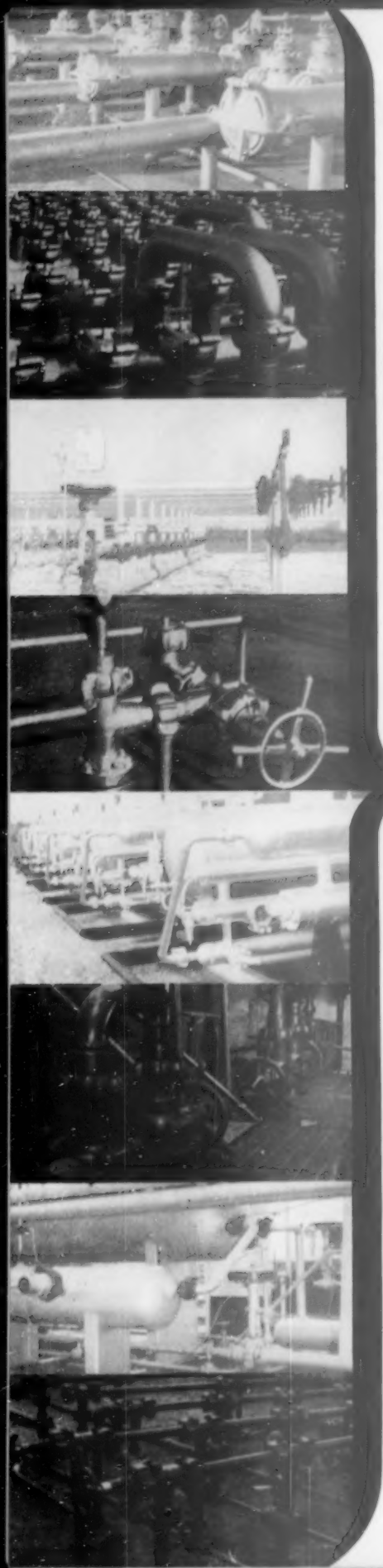
Power-Steering. Hydraulic power-steering permits effortless, fast steering and positive, shockless control.



Air-Assist Clutch. Operation of the big, double-plate clutch is virtually effortless, reduces driver fatigue.



Hydraulic Turbo-Braking Systems and powerful air-actuated brakes provide utmost safety for downhill going, assure safe and positive driver control at all times.

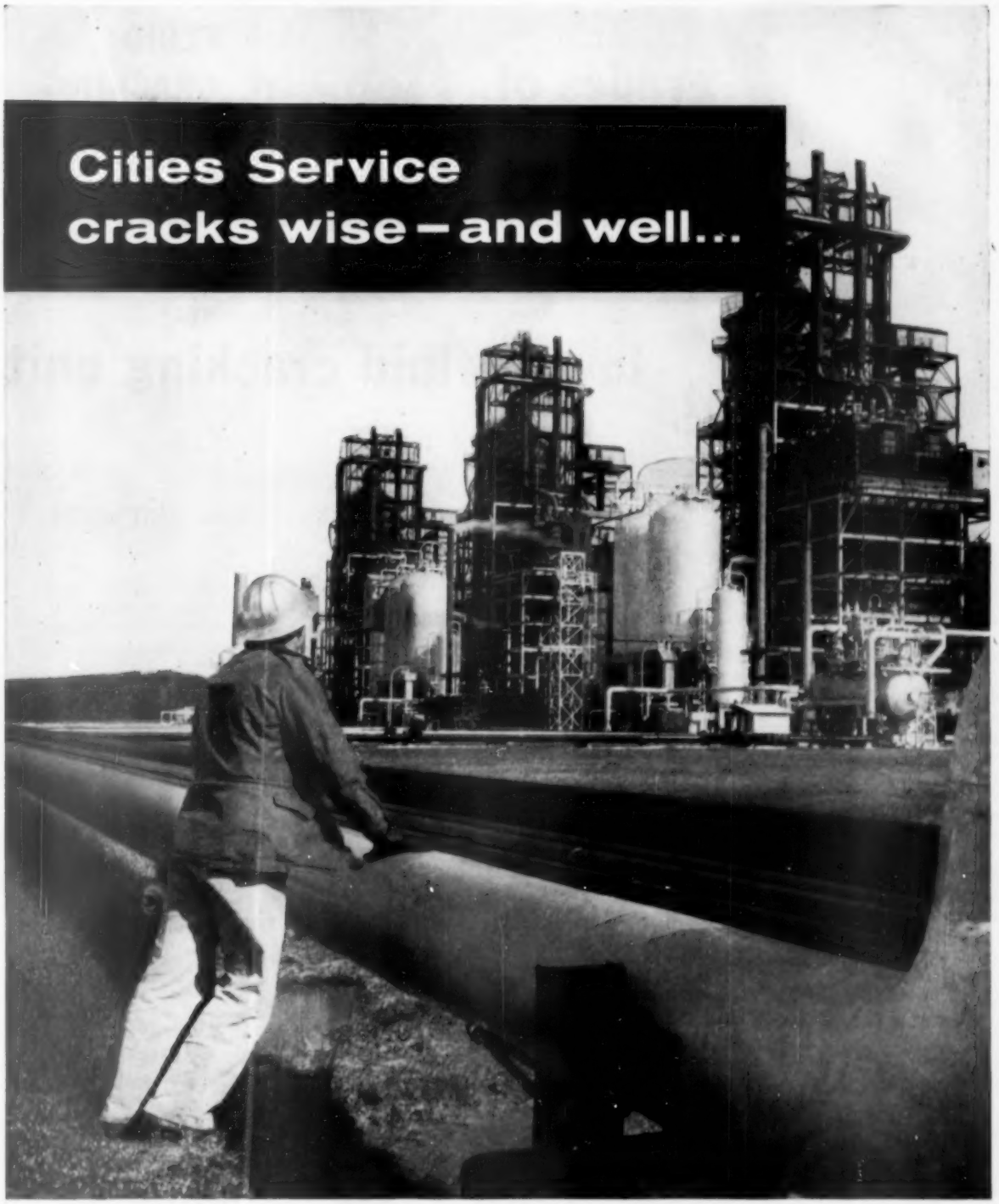


THERE IS ONLY ONE

UNIBOLT

Distinctive features: **Lighter but stronger** — its unique design results in minimum bulk and weight yet places more metal in shear to provide greater strength. **One bolt** — simplifies assembly and disassembly and serves only to draw tapered interlocking shelves together, carrying none of the load of the coupling itself. **Adaptability** — its design readily permits adapting it to numerous fittings, as well as pipe couplings. **Interchangeability** — any part for a given size and type coupling or fitting is interchangeable, permitting minimum warehouse stocks of UNIBOLT products and replacement parts. **Broad field of application** — ALL UNIBOLT products utilize the same basic mechanical design, only the seal rings, or gaskets, differ with the class of service.

THORNHILL CRAVER CO.
P. O. BOX 1184 HOUSTON, TEXAS



These three catalytic crackers dominate the skyline of our Lake Charles, Louisiana, refinery which normally processes 175,000 barrels of oil every day.

CITIES SERVICE

A Growth Company

3 grades of Aerocat® FLUID CRACKING CATALYST

for better fluidizing, circulating and attrition characteristics

in any fluid cracking unit

The importance of particle size distribution in catalyst efficiency is reflected in the names and performance of Cyanamid's three new grades of AEROCAT.

Following extensive research into existing fluid cracking unit needs, these grades were developed to cover the entire range of requirements. Now you can readily select the grade best suited to your unit operation and secure a higher degree of catalyst utilization through proper fluidization, circulation and reduced attrition. These grades represent a wide range, identified for your convenience by their Particle Distribution Index.

This is another advance in catalyst development that makes AEROCAT your most economical means to

- high octane yields
- high throughput
- low CO_2/CO ratio in flue gas
- high isobutane yield
- excellent heat, steam and sulfur stability

– all good reasons why 8 out of 10 users of synthetic catalyst specify AEROCAT Fluid Cracking Catalyst.

For details, write for a new technical data sheet "AEROCAT–Particle Size Distribution," or discuss your needs with our Technical Representative.

DESIGNED TO MEET ALL FLUID UNIT NEEDS

Aerocat 50/60 (Light) — for fluid units with low linear gas velocities, adequate dust disengaging space, excellent cyclone and Cottrell efficiency, low bed density needs.

Aerocat 60/70 (Intermediate) — for fluid units with moderate to high linear gas velocities, adequate catalyst recovery equipment.

Aerocat 75/85 (Narrow) — for fluid units with high linear gas velocities, moderate disengaging space, limited recovery equipment.

AMERICAN Cyanamid COMPANY

REFINERY CHEMICALS DEPARTMENT

30 Rockefeller Plaza, New York 20, N. Y.

In Canada: North American Cyanamid Limited, Toronto and Montreal

"Phi Beta McKee"

● It's the little gold lapel insignia McKee engineers wear. The color of the stone shows the number of years a man has been in the organization, and a good many of them show twenty-five years and more.

Sure, we do a little kidding about them—call 'em our "Phi Beta McKee's"—but we wear them with pride. That's because they really mean years of ***experience,*** and in this highly specialized business of designing and building petroleum and chemical processing plants, experience pays off.

The design, engineering or construction of a modern refinery or chemical plant is a complex undertaking requiring the coordinated effort of many kinds of technical specialists and skilled craftsmen. Here at McKee we have it down to a smooth-working system because so many of us have been working together at it for so many years.

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Arthur G. McKee & Company • Engineers and Contractors

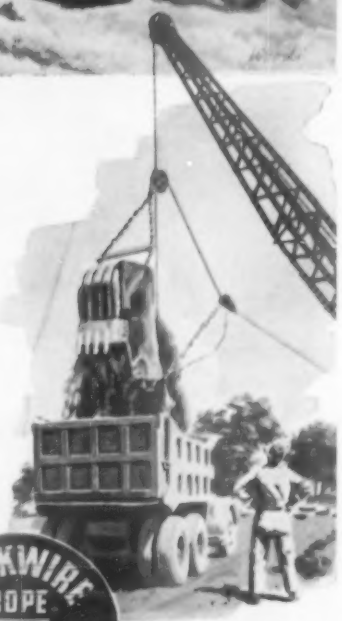
Headquarters: McKee Building • 2300 Chester Avenue • Cleveland 1, Ohio
Offices: New York • Tulsa, Oklahoma • Union, N. J. • Washington, D. C.
British Representatives of Metals Division: Head, Wrightson & Co., Limited
Canada: Arthur G. McKee & Company of Canada, Ltd., 350 Bay St., Toronto

the dirt flies faster—now with MUSCLES OF STEEL

Straining laborers plying pick and shovel are a bygone memory because of today's excavating and road-building equipment. Modern power shovels and draglines use *muscles of steel*—rugged wire rope—to keep the dirt flying fast.

Helping to clear the way for needed highways is another of the important ways in which Wickwire Rope contributes *muscle* to America's might.

You'll find Wickwire Rope, too, in the mines and the quarries . . . in the oil fields and logging camps . . . with the fishing fleets . . . and in numerous materials handling operations. Whatever the job may be, the extra care and quality fabrication that goes into Wickwire Rope proves itself in longer life, more economical service and utmost reliability.



***every* industry benefits from wire rope**

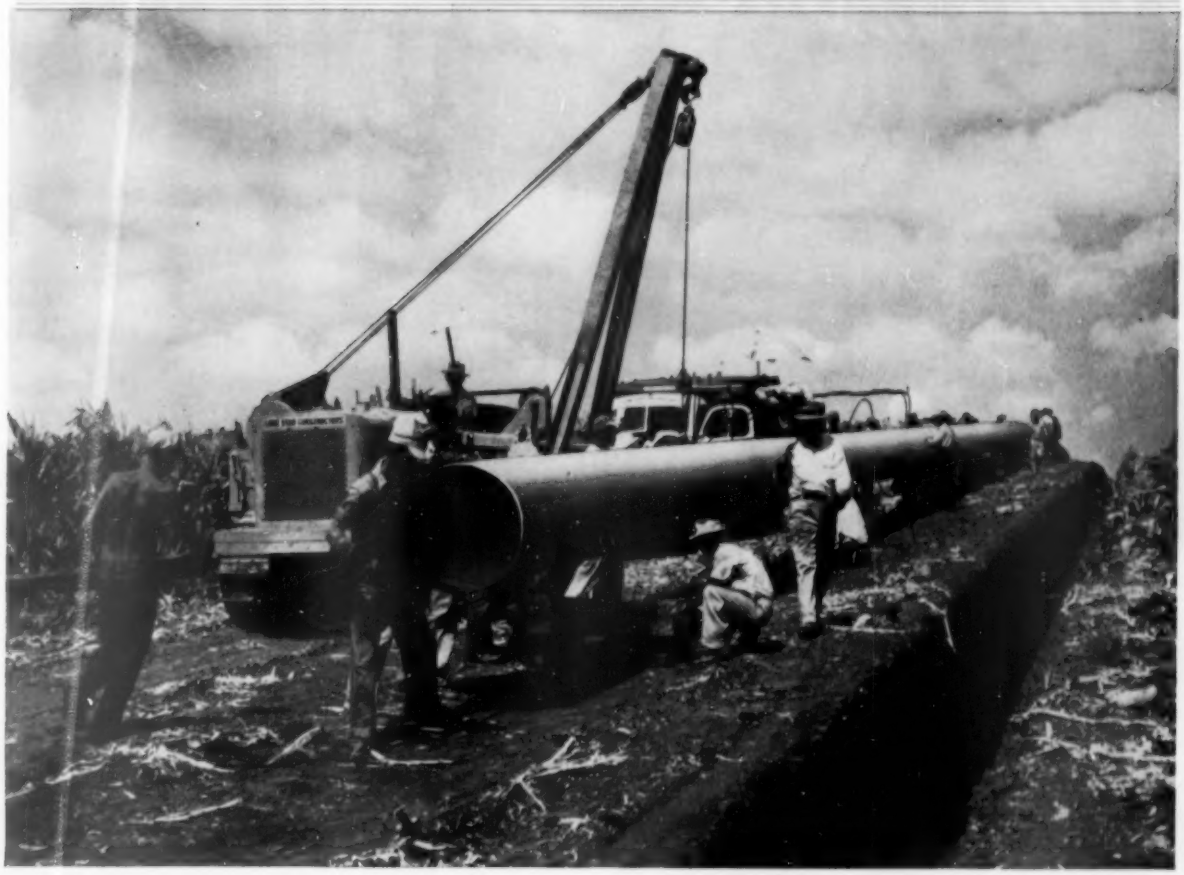
WICKWIRE ROPE

CF&I PRODUCT OF WICKWIRE SPENCER STEEL DIVISION
THE COLORADO FUEL AND IRON CORPORATION

2533

THE COLORADO FUEL AND IRON CORPORATION—Abilene (Tex.) • Denver • Houston • Odessa (Tex.) • Phoenix • Salt Lake City • Tulsa
PACIFIC COAST DIVISION—Los Angeles • Oakland • Portland • San Francisco • Seattle • Spokane
WICKWIRE SPENCER STEEL DIVISION—Boston • Buffalo • Chattanooga • Chicago • Detroit • Emlenton (Pa.) • New Orleans • New York • Philadelphia

PIPE LINE PROGRESS



Northern Natural achieves billion cu. ft. daily line capacity... builds with A. O. SMITH LINE PIPE

Northern Natural Gas Company this year completes its expanded two-year construction program, with total daily pipe line capacity up to 1,100,000,000 cu. ft. 460 miles of new main line loops were laid in the two-year program, with twelve sections of loop line being laid each year. New line facilities bring natural gas to 71 additional communities in Iowa, Nebraska, Minnesota and South Dakota . . . so that the company now serves a total of 307 communities in the Northern Plains.

A. O. Smith's participation in the job consisted of 178 miles of 30-inch pipe and 60 miles of 20-inch pipe.

Highly regarded in the industry because A. O. Smith welded steel pipe is consistently accurate in size, roundness and end-to-end matchup. A. O. Smith has supplied all or a part of the line pipe for most major pipe lines in the country.

A. O. Smith Line Pipe is available in a complete range of sizes and wall thicknesses, from 8⅝-in. to 36-in. diameters.

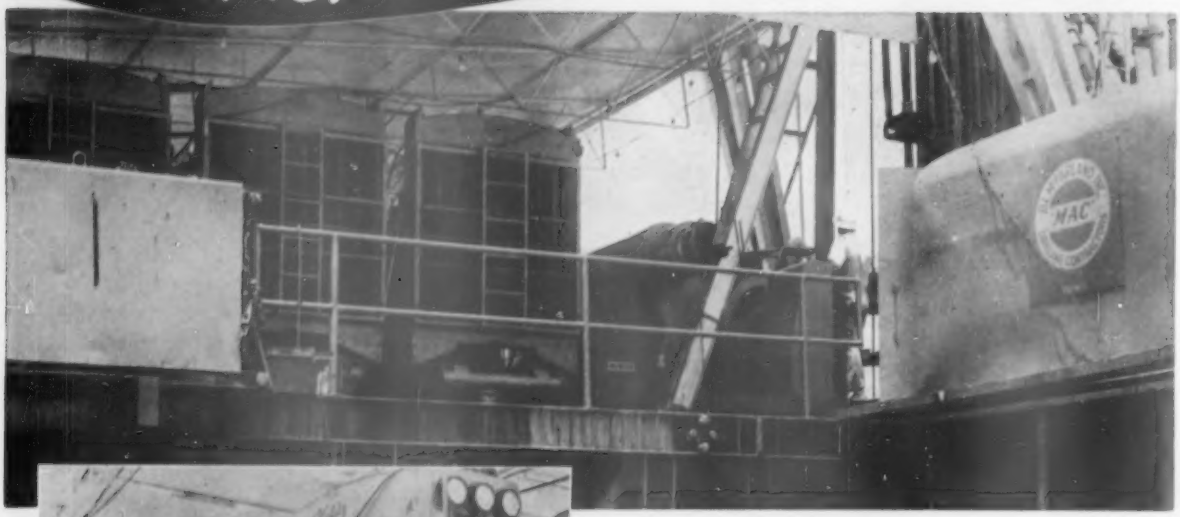
The A.O. Smith Casing Mill is operating at capacity to supply vitally needed casing for the Oil and Gas Industry.

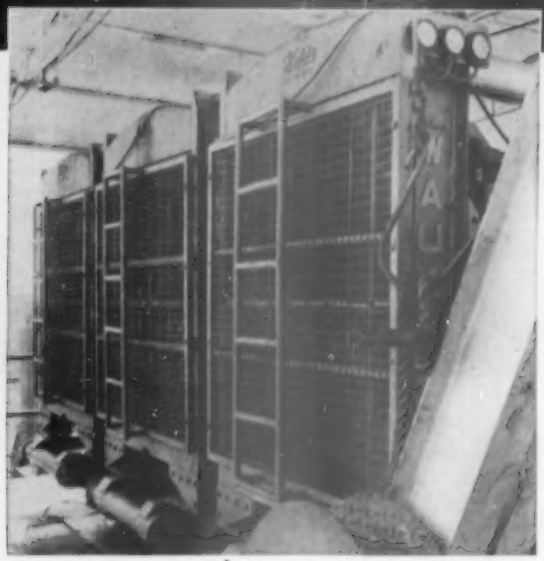
Through research ...a better way

A.O.Smith
CORPORATION
TUBULAR PRODUCTS DIVISION
Milwaukee 1, Wisconsin

Chicago 4 • Dallas 2 • Houston 2 • Los Angeles 22 • Midland 5, Texas • New Orleans 12 • New York 17 • Pittsburgh 19 San Francisco 4 • Seattle 1 • Tulsa 3 • Washington 6, D.C.
International Division: Milwaukee 1

Down 13,000'...still making hole...





New BREWSTER N-95 Rig is powered by WAUKESHAS

B. F. MacFarland, Inc., drilling contractors of Fort Worth, Texas, are already down to 13,000' and still making hole, with the new Brewster N-95 14,000' rig. This rig's power plant—three of the ever-reliable Waukesha LROU Oil Field Gas Power Units—a great combination of speed and flexibility! Six cylinders, 8½-in. bore x 8½-in. stroke, 2894 cu. in. displacement, max. hp. (each unit) 405 on butane, 361 on natural gas, at 1000 rpm. Other models of this unit for gas, normal Diesel, or turbocharged Diesel operation—to 526 hp.

WAUKESHA ENGINES and POWER UNITS 10 hp. to 600 hp.

Send for Bulletin 1079

WAUKESHA MOTOR COMPANY
Waukesha, Wisconsin
New York • Tulsa • Los Angeles

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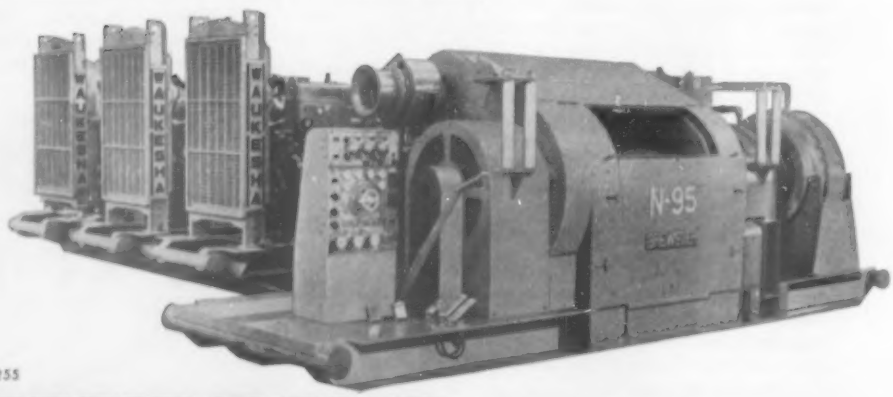

WAUKESHA Oil Field Power

LOOK OUT..FIRE!

TWO OF THE GREATEST NAMES IN FIRE PROTECTION HAVE JOINED FORCES

PYRENE and C-O-TWO, world-renowned manufacturers of approved fire protection equipment, are now unified under the same management to give you the finest and most complete line on the market today . . .

- **built-in fire detecting systems that quickly respond to smoke, heat or flame . . .**
- **all types of portable fire extinguishers and built-in fire extinguishing systems that kill fire fast . . .**
- **plus an expert fire protection engineering service that gives you unbiased advice on what is best for your particular fire hazards.**

Don't take unnecessary chances . . . the combined fire protection experience of PYRENE and C-O-TWO over the years is at your disposal without obligation. Get complete facts today!

Pyrene

PYRENE — C-O-TWO

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C-O-TWO

COMPLETE FIRE PROTECTION

portable fire extinguishers . . . built-in fire detecting and fire extinguishing systems

CARBON DIOXIDE · DRY CHEMICAL · VAPORIZING LIQUID · SODA-ACID · WATER · CHEMICAL FOAM · AIR FOAM

BALANCED

COUNTERBALANCED

LeBUS GROOVING & COUNTERBALANCE CONTROL PYRAMID SPOOLING SYSTEM*

Sometimes the "Balancing" of Ledger books can be a problem. But the "Counterbalancing" of hoisting rig drums was no problem to LeBus Engineers. With years of experience behind them, LeBus Engineers developed their "Three-Point" System of GROOVING & COUNTERBALANCE CONTROL PYRAMID SPOOLING SYSTEM to a point where they have practically eliminated all vibration with respect to Wire Line Spooling.

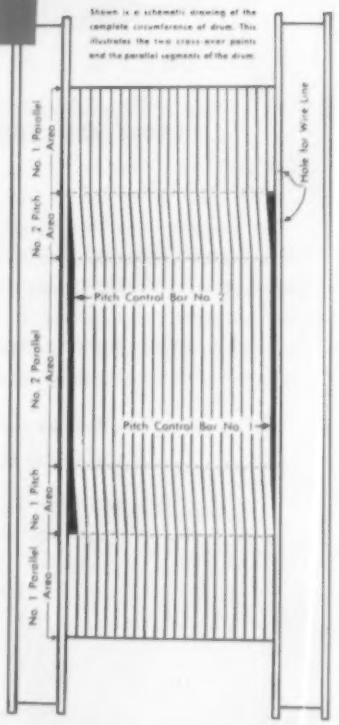
Not only has vibration been reduced to a minimum but LeBus has also practically done away with Wire Line cutting-in, scrubbing, pinching, or squeezing, plus wire line whip. Each highly destructive to wire line. With the LeBus System the drums will spool much smoother at slower or at faster speeds.

Thousands of operators are using LeBus Grooving with great satisfaction – *SAVINGS!*

See What LeBus GROOVING WILL DO FOR YOUR RIG.

Consult a LeBus Engineer today.

*Patented and Other Patents Pending


Shown is a schematic drawing of the complete circumference of drum. This illustrates the two cross-over points and the parallel segments of the drum.
No. 1 Parallel Area
No. 2 Pitch Area
No. 2 Parallel Area
No. 1 Pitch Area
No. 1 Parallel Area
Hole for Wire Line
Pitch Control Bar No. 2
Pitch Control Bar No. 1

LeBus International Engineers, Ltd.

Executive Offices: 305 Wichita National Bank Building, WICHITA FALLS, TEXAS

Sales, Service Control and Warehouse Stock: LONGVIEW, TEXAS

They Say—

Oil Flow Has Changed

". . . Facts are facts and I wouldn't want to mislead anyone—the direction of oil flow has changed and I doubt that it will ever go back to the way it used to be.

"Since World War II, the Middle East has moved into the picture and now 78 per cent of Europe's requirements come from there. Today the United States is no longer a major exporter of oil, and Europe only gets 4 per cent of her petroleum requirements from us, and 14 per cent from the Caribbean.

"Whereas the big volume oil-flow used to be from West to East, its now more nearly from South to North . . ."

Chester F. Smith, director and vice president of Standard Oil Co. (N.J.), in an address in Atlantic City before the National Petroleum Association.

Exploration Education

Dear Sir:

It would be appreciated if you could advise me of any correspondence courses, if any, which cover the oil-exploration industry. I am particularly interested in the administrative aspects as I am at present employed as assistant to the managing director of the above company (Australian Oil & Gas Corp., Ltd.), which is an oil and gas exploration undertaking operating in the Sydney basin.

As you can imagine, courses of this nature are nonexistent in Australia due to there being little or no interest in the industry previously . . .

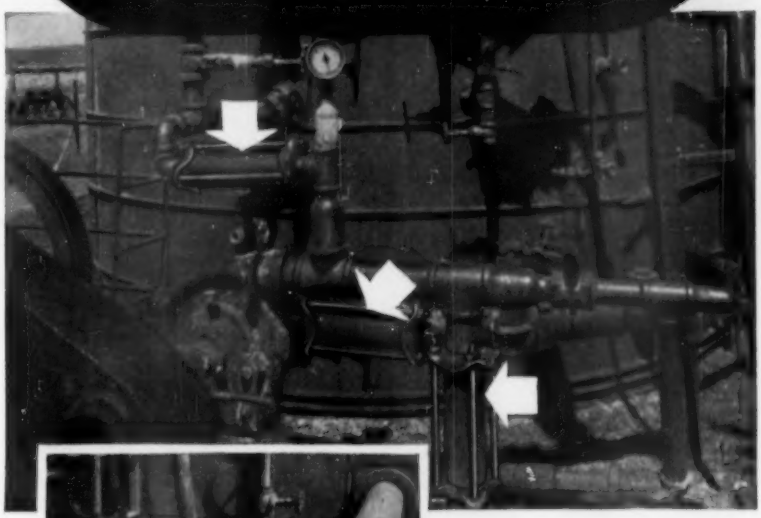
E. C. Liddle
Sydney

Editor's Note: The Oil and Gas Journal welcomes such requests. Reader Liddle was supplied with a list of exploration books. Similar lists can be supplied on other oil subjects, and many of the books can be ordered from The Journal.

The Public and Natural Gas

"The industry, as a result of the Supreme Court decision in the Phillips case, finds itself in a position where it is now even more important that the public understand the nature of the

around a drilling rig . . .
the DRESSER way
is easier . . . surer!



ABOVE—Dresser Style 40 Long Sleeves installed on drilling-rig, salt-water tank lines. LEFT—A 12" Style 40 Long Sleeve installed on mud tanks of rotary drilling rig.

You'll find plenty of uses for Dresser Couplings and Long Sleeves around a drilling rig . . . or anywhere else you're joining pipe.

No pipe threading is necessary and the only tool you need is a wrench. Dresser Couplings are that simple to make up. You get a permanent bottle-tight connection every time—even on offset or deflected pipe.

AVAILABLE AT LEADING OILFIELD SUPPLY STORES

Style 38 Coupling | Style 40 Long Sleeve | Hydrepair* Asbestos Cement Pipe Clamp | Style 63 Expansion Joint | Style 39 Insulating Coupling

*HYDREPAIR is a trade-mark of Dresser Manufacturing Division

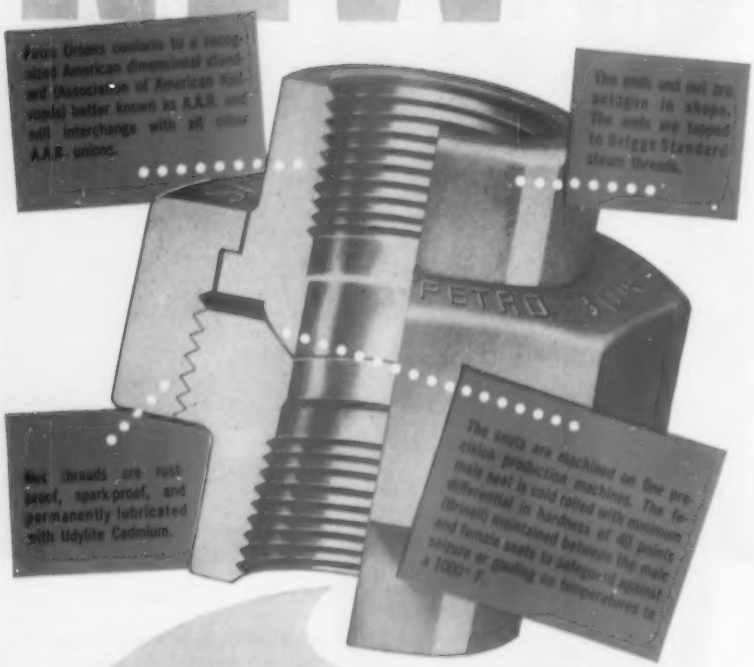
DRESSER® COUPLINGS

Dresser Manufacturing Division, 49 Fisher Ave., Bradford, Pa. (One of the Dresser Industries).
Warehouses: 1121 Rothwell St., Houston, Texas; 101 S. Airport Blvd., S. San Francisco, Calif.

NEW

FORGED STAINLESS STEEL

SCREWED OR SOCKET WELD


Petro Unions conform to a recognized American dimensional standard (Association of American Railroads) better known as A.A.R. and will interchange with all other A.A.R. unions.
The ends and ovel are octagon in shape. The ends are tapped to Briggs Standard steam threads.
PETRO
Nut threads are rust proof, spark-proof, and permanently lubricated with Udylite Cadmium.
The seats are machined on fine precision production machines. The female seat is cold rolled with minimum differential in hardness of 40 points (Brinell) maintained between the male and female seats to safeguard against seizure or galling at temperatures to a 1000° F.

PETRO 304

A combination of the famous Petro A.A.R. features, hot forging from stainless steel bars and electro polishing to a clean, bright surface has produced these new stainless steel unions that are superb for use on all processing lines where stainless steel is required.

PETRO DUAL

These new unions with stainless steel hub ends and Udylited carbon steel nuts have been developed to provide top performance on all services where atmospheric corrosion is not a problem.

PETRO 316 and PETRO 347

These stainless steel unions (available with either stainless or carbon steel nuts) can b furnished on special order.

SIZES ⅛" THRU 2", PRESSURES 900 LBS. S.W.P., 3000 LBS. C.W.P.

ORIFICE TYPE UNIONS ARE ALSO PRODUCED IN STAINLESS STEEL.

WRITE DEPARTMENT C

For additional information or refer to listings In the Composite or Refinery Catalogs.

ORDER BY TRADE NAME FROM YOUR LOCAL JOBBER

CLAYTON MARK & COMPANY

5900 DEMPSTER STREET — EVANSTON, ILLINOIS

natural-gas business . . . particularly insofar as the discovery and production of natural gas is concerned."

C. P. Rather, president of Independent Natural Gas Association, in an address at the annual meeting in New Orleans of I.N.G.A.

Imports Imperil Security

"We cannot defend ourselves with foreign oil. Russia has 300 new, modern submarines ready to sink foreign oil coming to this country should there be a World War III.

". . . Is their (the importers') loyalty greater to their stockholders than to America?

"Oil security has become the top security of our nation. Our national security is imperiled by imports of oil."

Gen. Ernest O. Thompson, chairman of the Texas Railroad Commission, in an address in Evansville, Ind., before a joint meeting of oil men from Indiana, Illinois, and Kentucky.

The Senator and Imports

"I believe in the Good Neighbor policy, and am aware that it is necessary for coexistence, but we must be free to develop our resources. International relations take second place when imports threaten to impair or destroy our national oil industry.

Oklahoma Sen. Robert S. Kerr, chairman of the board of Kerr-McGee Oil Industries, Inc., in an address in Pascagoula, Miss., at the launching of Ker-Mac Rig 44.

A Threat to Refining

". . . The plain fact is that we are preparing to meet the threat of an atomic war on the basis of depending on a petroleum-refining industry nearly twice as big as the industry which we had at the beginning of World War II but which, because of its concentration, is now 38 per cent more vulnerable to attacks upon our great industrial communities."

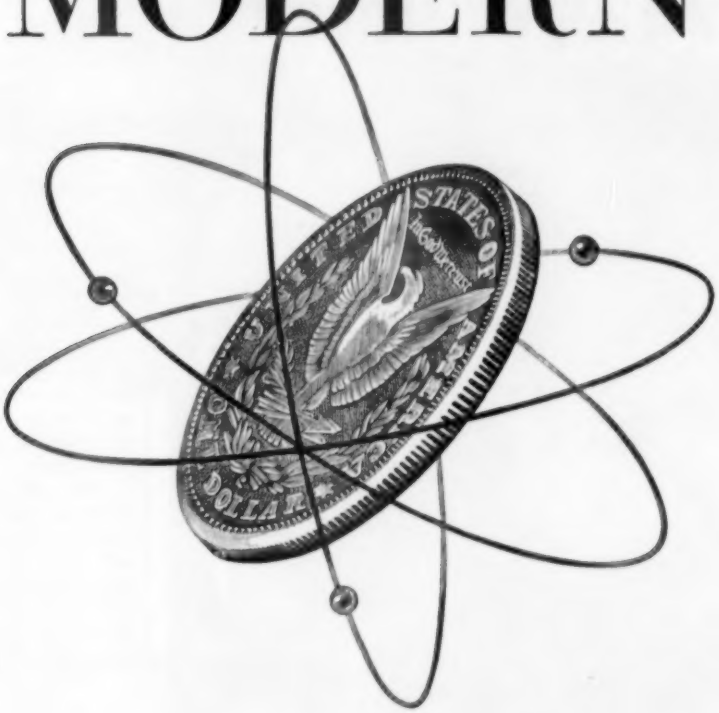
A. W. Scott, president of National Petroleum Association, in an address at the N.P.A. meeting in Atlantic City.

Junior's Geology

Dear Sir:

I just read your article "Geology for the Jean-Agers" *(The Oil and Gas Journal, September 20, page 391)* and found it very interesting. I just want to commend you for plugging the efforts which we have been making in the Society of Exploration Geophysicists and the American Association of Petro-

MODERN



Throughout the 48 states and in many foreign lands, large and small companies in hundreds of industries use the modern banking services provided by New York's first bank. Our Commercial Department offers every up-to-date facility, backed by a century and a half of experience in meeting the banking requirements of American industry.

You will find this Bank alert to your needs, progressive in outlook and resourceful in seeking solutions to your banking problems.

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Foreign Transactions
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Executor and Trustee
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New York's First Bank • Founded 1784

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GIVE YOUR PIPE A DECENT BURIAL

When you lay out good money for steel pipe, it's just good sense to make sure it gets the best protection possible. That's why PLS engineers go all out in applying long experience and the most modern mechanical facilities to protect your pipe investment through controlled cleaning, priming, coating and wrapping. For example, PLS pioneered mechanical cleaning and priming of pipe. Today, specially-designed equipment as shown above, cleans and primes your pipe in the same operation—to assure a proper bond between the bare pipe and the coating. Nothing is overlooked at PLS to provide peace-of-mind protection for your pipe.

DEPENDABLE SERVICE SINCE 1931

PLS Pipe Line Service Corporation

Pioneers in Steel Pipe Protection

General Offices and Plant: Franklin Park, Illinois

Plants at Glenwillard, Penna.; Longview, Texas; Corpus Christi, Texas; Harvey, La.; Sparrows Point, Md.; and Monmouth Junction, N.J.

leum Geologists recently toward recruiting more qualified manpower into the exploration industry. . . .

. . . I will probably wind up by purchasing one of these juvenile geology kits for my oldest boy, who is still quite a youngster, but is very interested in rocks.

Roy L. Lay
Assistant to Vice President
Producing Department
The Texas Co.
New York.

Residue Gas Problem

". . . The greatest difficulty inherent in the entire operation (of residue gas gathering) is the variable quantity of residue gas available to the pipeline by reason of proration of oil production.

"The allowable production in the Permian basin in Texas in August was cut to 15 producing days. The cut of one day's production means a cut of approximately 30,000,000 cu. ft. of gas per day from our system. This makes it necessary for any company marketing large quantities of residue gas to have in reserve very great deliverability of dry gas that can be used at will to take the place of the residue gas that may be taken away from the line by reason of proration of oil, over which the pipeline company has absolutely no control . . ."

Paul Kayser, president of El Paso Natural Gas Co., in an address before the Interstate Oil Compact Commission meeting in Omaha.

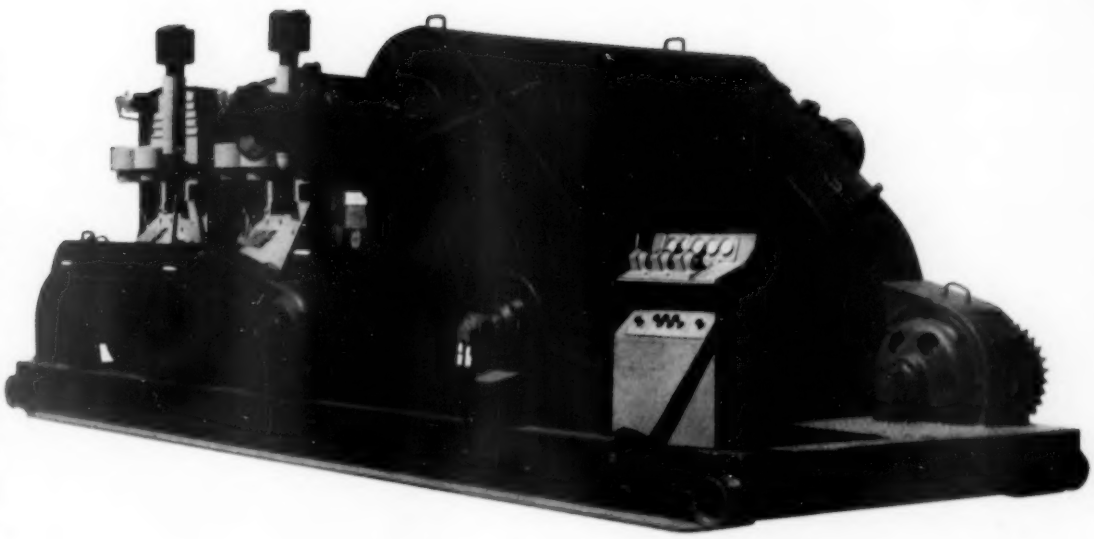
A New Industry

"The sudden wild activity in uranium . . . causes one to wonder where it will lead.

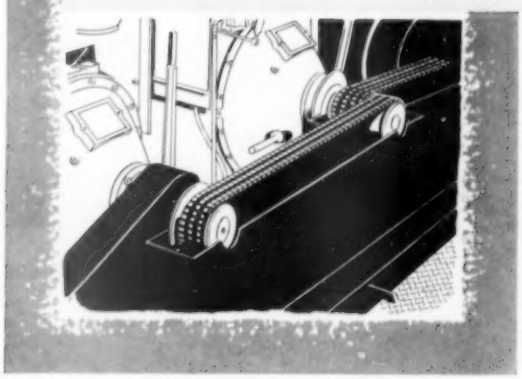
"Some people argue that it will be a short-lived boom . . . Sober reflection, however, forces one to reach a different conclusion. Something revolutionary has occurred, a new industry has been born . . .

". . . Now comes a new source of energy which may compete with both natural gas and oil. The present cost of the new energy is very high and the mechanical efficiency very low, but these are handicaps that time will cure . . .

". . . By 1975, it is predicted that our population will be over 210 million, an increase of 33⅓ per cent over our present population of 162,000,000. Energy requirements may be 50 per



Emsco's versatile "Little Rigs" have big rig quality



Choice of Prime Movers. A chain drive between the built-in hydraulic torque converter and engine (or engines) gives the operator complete freedom in his selection of power. Any make of high or low speed engine, coming within the rig's recommended horsepower range, may be used by applying proper chain drive ratio between the power source and torque converter.

The Emsco GB-160-T and GB-250-T provide faster, more economical drilling for shallow to medium depth wells, servicing, and deep workover operations.

Emsco's little rigs are rugged, yet lightweight and completely portable . . . get you on and off the job faster. Packaged as a unit, they are ideal for truck or trailer mounting.

All controls are mounted in a console, with one-lever control valves for hoisting and rotating. The console is forward-mounted to give the driller an unobstructed view of all floor and derrick operations. Friction clutches are direct air-operated.

An inboard-mounted torque converter, driving through a two-speed selective transmission, provides an infinite range of speeds and permits use of maximum obtainable horsepower at any time. Call CONTINENTAL for details on Emsco's dependable GB-160-T and GB-250-T.

CONTINENTAL

Serving the Oil and Gas Industries

THE CONTINENTAL SUPPLY COMPANY
General Offices: Dallas, Texas
Representatives in all principal oil fields of the world

EMSCO

REG. U.S. PAT. OFF.

EMSCO MANUFACTURING COMPANY
Garland, Tex. LOS ANGELES, CALIF. Houston, Tex.
General Sales Offices: Dallas, Texas

E-168

EMSCO'S R-SERIES TRAVELING BLOCKS
increase wire line life

EMSCO's slim-lined R-Series Traveling Blocks are safer, easier and more economical to operate.

Sheaves of R-Series Blocks are forged steel, making them stronger and longer-lasting. Flame-hardening of rope grooves produces a wear-resistant surface and greatly increases wire line life. The sheaves are mounted on double row tapered roller bearings which provide positive positioning and eliminate side friction.

Added strength, smoother surfaces, and a more compact, slim-lined design are achieved through the use of rolled steel side plates. The low center of gravity of the R-Series Blocks eliminates canting . . . assures a fast-falling and straight-traveling block.

A reversible sheave bearing lubrication cartridge that can be inserted from either side permits the blocks to be reversed to balance sheave wear. The lubrication fittings remain accessible from the working platform at all times.

EMSCO R-Series Blocks are available in sizes and capacities to meet modern drilling requirements. Call your nearest CONTINENTAL store for details.

MATCHED BLOCKS
for shallowest to deepest drilling

MODEL NUMBERS INDICATE DIAMETER OF SHEAVES

R-30	R-36	R-44	R-52	R-60
125 TONS	200 TONS	300 TONS	450 TONS	450 TONS

EMSCO

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CONTINENTAL
Serving the Oil and Gas Industries

THE CONTINENTAL SUPPLY COMPANY
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Representatives in all principal oil fields of the world

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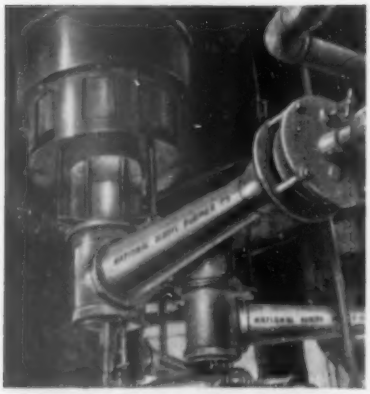

for Vertically fired Petroleum heaters only...

the *NEW*
NATIONAL AIROIL VERTICAL
Pitch-Oil-Gas Tandem Combustion Units

Exclusively for vertical firing, the new National Airoil VERTICAL Tandem Block Units retain all the features of our regular, well known Tandem Units . . . *plus:* special, pre-cast refractory shapes for easier, cost-saving installation and maintenance; secondary air inlet louvres for positive control of flame pattern; and, all steel duplex detaching gear which enables swift, simple burner changeover.

VERTICAL Tandem Units hold air in the combustion zone until fuel and heated air are thoroughly mixed. This means that ignition takes place in a hot zone; the result: high fuel economy through more rapid combustion with a minimum of excess air. NATIONAL AIROIL'S patented Tandem Combustion Blocks allow secondary air to be easily and accurately controlled. By adjusting air control louvres, flame can be shaped to radiate heat uniformly without tube impingement.

The VERTICAL Tandem Unit is always fired with NATIONAL AIROIL Combination Oil and Gas Burners . . . has a high turndown ratio with a steady flame . . . maintains required flame temperature using either fuel oil or gas. With the TANDEM UNIT'S clean flame, a cold furnace can be brought to full capacity in a short time.

"Many, many more hours on stream, without shutdown" . . . yes, YOU will realize higher profits from YOUR heaters when National Airoil VERTICAL Tandem Units are specified. Our new literature is yours for the asking.

NATIONAL AIROIL BURNER CO., INC.

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2512 South Boulevard, Houston 6, Texas

cent higher. Uranium may supply a large part of that additional energy, and when oil and gas supplies dwindle, it will replace them . . ."

Dorsey Hager, consulting geologist, Salt Lake City, in an article discussing uranium and the oil business.

Low Prices and Demand

"Continued oversupply and more than ample stocks can lead only to low prices, and in the oil industry low prices have never generated but little additional demand. . . ."

George J. Hanks, chairman of the board of South Penn Oil Co., in an address before the Pennsylvanian Bankers Association.

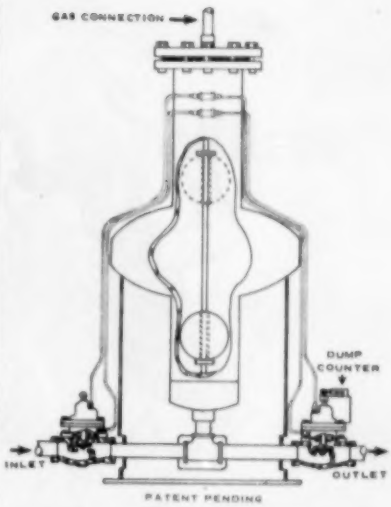
CALENDAR OF EVENTS

OCTOBER

12-15 American Chemical Society, national meeting, Chicago Coliseum, Chicago.
12-15 **Eighth National Chemical Exposition Chicago Coliseum, Chicago.**
12-15 National Association of Corrosion Engineers, technical committees, Dallas.
14-17 **Permian Basin Oil Show, Odessa, Tex.**
17-20 **American Institute of Mining and Metallurgical Engineers, petroleum division, fall meeting, Plaza Hotel, San Antonio.**
18-20 Joint Lubrication Conference, American Society of Mechanical Engineers and American Society of Lubrication Engineers, Lord Baltimore Hotel, Baltimore.
21-22 **Western Petroleum Refiners Association, regional meeting, Garrett Hotel, El Dorado, Ark.**
21-23 Rocky Mountain Oil and Gas Association, annual meeting, Cosmopolitan Hotel, Denver.
22-24 Golden Trend Oil Exposition, County Fairs Building, Pauls Valley, Okla.
24-26 **Independent Petroleum Association of America, annual membership meeting. Mayo Hotel, Tulsa.**
25-27 Diesel and Gas Engine Power Plant Operators Conference, sixth annual conference, Oklahoma A. & M. College, Stillwater, Okla.
25-27 National Lubricating Grease Institute, annual meeting, Mark Hopkins Hotel, San Francisco.
26-28 **Society of Automotive Engineers, national diesel engine meeting, Statler Hotel, Cleveland.**
26-29 National Clay Minerals Conference, Rice Institute campus, Houston.
28 Canadian Petroleum Association, Saskatchewan division, annual meeting, Hotel Saskatchewan, Regina.
29 Natural Gasoline Association of America, southern regional meeting, Blackstone Hotel, Tyler, Tex.

NOVEMBER

1-3 Geological Society of America, annual meeting, Statler Hotel, Los Angeles.
3-5 **Gulf Coast Association of Geological Societies, fourth annual meeting, Rice Hotel, Houston.**



PATENT PENDING

ROLOCHECK

Trade Mark

The New Oil Well Meter

A new oil well meter has been developed which is simple in design, yet very accurate and eliminates expensive maintenance problems caused by gas, sand and other solids in crude oil. The meter has a high maximum rate and features a zero minimum rate. The new Model No. RM 1-24 will handle as much as 1,440 bbl. per day at 12 psi.

Gas and sand will not affect the new meter any more than they would affect normal control valves in oil lines. The meter actually dumps a positive calibrated dump each time. It may be installed on existing heater-treaters, vertical or horizontal separators. The Rolocheck meter eliminates liquid level controls on the separator as it actually controls the liquid level in the vessel.

OPERATION

(1) Filling: When float hits lower stop, pilot trips to close outlet valve and open inlet valve simultaneously.

(2) Dumping: When float hits upper stop, pilot trips to open outlet valve and close inlet valve simultaneously.

ACCESSORIES

GAGE COCKS, GLASS, & GUARD RODS
0-200° THERMOMETER & WELL

SPECIFICATIONS

TYPE	RM 1-24
WORKING PRESSURE	150 PSI
CAPACITY B.P.D.	MIN. -0. MAX. -1440*
HEIGHT	4'-6"
WIDTH	2'-0"
WEIGHT	356 LBS.
GAS CONNECTION	1"
OIL OUTLET	1½"
OIL INLET	1½"

**At 12 psi. pressure differential. Available with 2" valves for greater capacity.*

ROLO MANUFACTURING COMPANY

P. O. Box 6763,
Houston 5, Texas

BRANCHES: Corpus Christi, Midland, Kilgore, Tulsa, New Orleans, Los Angeles, Casper; Mt. Vernon, (Ill.); Lima, Peru; Caracas, Venezuela (PETICON).

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KEEP 'EM RUNNING!

Cummins Diesel engines run "trouble-free" year after year with factory-authorized Cummins service. Sales, service, and genuine Cummins parts in the Mid-Continent area 24 hours a day from 13 factory-type service repair shops.

Contact your nearest Cummins Service Shop

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Modernize, Economize, Standardize with

CUMMINS DIESEL

CUMMINS
Sales & Service, Inc.

GENERAL OFFICES • 608 MAIN STREET • FORT WORTH, TEXAS

4 American Association of Oilwell Drilling Contractors, third annual South Louisiana safety clinic, New Iberia, La.
4-5 Society of Automotive Engineers, national fuels and lubricants meeting, Mayo Hotel, Tulsa.
4-6 Air Pollution Control Association conference, Biltmore Hotel, Los Angeles.
5 Southern Gas Association, conference on field production of natural gas, Herring Hotel, Amarillo.
8-9 Gas Measurement Institute, Legion Hall, Liberal, Kans.
8-11 American Petroleum Institute, thirty-fourth annual meeting, Conrad Hilton Hotel and Palmer House, Chicago.
11-12 American Association of Petroleum Geologists, Pacific section annual meeting, Biltmore Hotel, Los Angeles.
17-18 North Texas Section, American Institute of Mining and Metallurgical Engineers, and Production Committee of the North Texas Oil and Gas Association, symposium on secondary recovery, Wichita Falls, Tex.
18-19 National Association of Corrosion Engineers, fourth annual conference of western region, Hotel Biltmore, Los Angeles.
18-19 Society of Exploration Geophysicists, eighth annual midwestern meeting, Adolphus Hotel, Dallas.
28-Dec. 3 American Society of Mechanical Engineers, Statler Hotel, New York.

DECEMBER

2-4 Interstate Oil Compact Commission, winter meeting, Drake Hotel, Chicago.
2-4 American Chemical Society, Southwest Regional meeting, Fort Worth, Tex.
3 Natural Gasoline Association of America, Panhandle-Plains regional meeting, Herring Hotel, Amarillo, Tex.
12-15 American Institute of Chemical Engineers, annual meeting, Statler Hotel, New York.

1955

JANUARY

17-18 Kansas Oil Men's Association, annual convention, Baker Hotel, Hutchinson, Kans.
26-28 Symposium on instrumentation for process industries, A. & M. College of Texas, College Station, Tex.
27-28 American Chemical Society, symposium on hydrocarbon chemistry, Rice Hotel, Houston.

FEBRUARY

14-16 Rocky Mountain section of A.A.P.G., annual regional convention, Billings, Mont.
16-18 National Association of Corrosion Engineers, sixth annual short course for pipeliners, Mayo Hotel, Tulsa.
25 National Gasoline Association of America, Permian basin regional meeting, Scharbauer Hotel, Midland, Tex.

MARCH

4 Southern Gas Association, transmission management conference, Shamrock Hotel, Houston.
7-11 National Association of Corrosion Engineers, Palmer House, Chicago.
24-25 American Gas Association, gas supply, transmission, and storage conference, Wm. Penn Hotel, Pittsburgh.

JUNE

16-18 Interstate Oil Compact Commission, Denver.

Web Wilson

Hydra Hooks

Famous Web Wilson "Dash Pot" Action
Full 7" Spring Travel
Fewer Parts, Less Maintenance
Shorter Length, Streamlined Design
Direct Connection to Popular Blocks

The new HYDRA HOOK combines outstanding features of previous Web Wilson Hooks with many modern improvements, such as: Elimination of a Top Bearing; a Completely Packed-Off Body to prevent oil leakage and keep the "dash pot" action at peak performance.

The 150-Ton HYDRA HOOK (illustrated at right) is a full 8 inches shorter and 1,200 pounds heavier than its predecessor. A dream in streamlining, its additional weight and perfect balance make even the lightest traveling blocks fall fast and true.

AVAILABLE NOW: the 100-Ton, 150-Ton and 250-Ton Sizes.
READY SOON: the 350-Ton HYDRA HOOK.

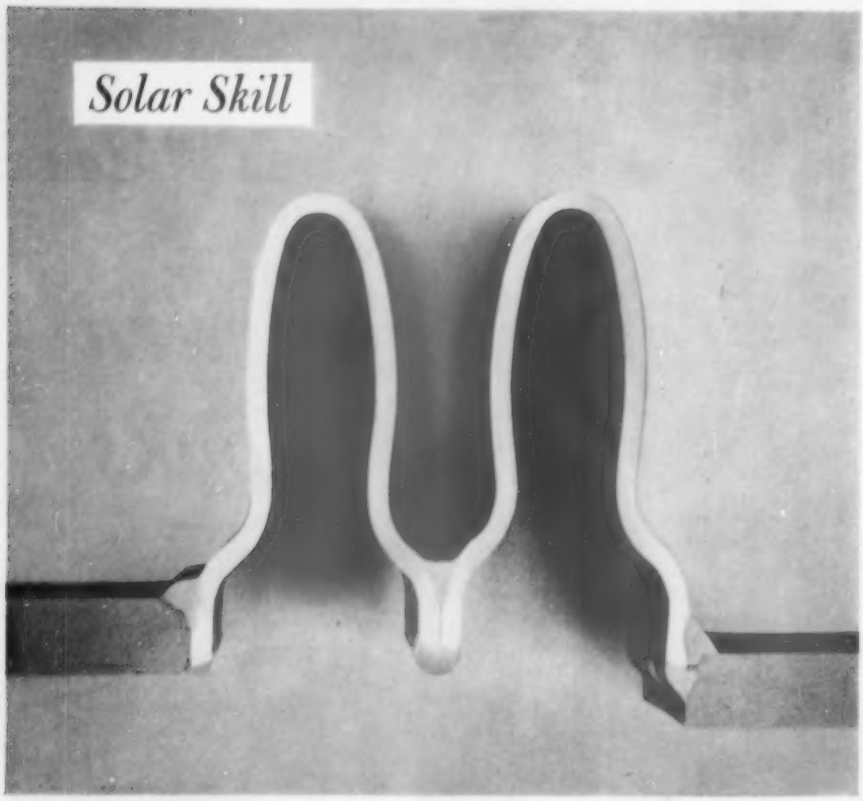
for additional information write . . .

WEB WILSON

Oil Tools INC.

FIELD PROVEN

LOS ANGELES, CALIFORNIA • DALLAS, TEXAS • NEW YORK, N.Y.
Mail address: Box 96, Los Angeles 2, California



Cross-section photo of a typical industrial expansion joint fabricated for a petroleum refinery. Welds were made with the shielded inert gas metal arc (SIGMA) process, including lap, fillet, edge and groove types, joining AISI type 321 stainless bellows and Schedule 285 type mild steel pipe ends.

Solar's unique welding skills can meet your most exacting requirements

WHEN YOU NEED a precision part or component requiring welding perfection, Solar is the logical supplier. Probably no other manufacturer can equal Solar's knowledge and experience in the precision welding of alloys and super metals.

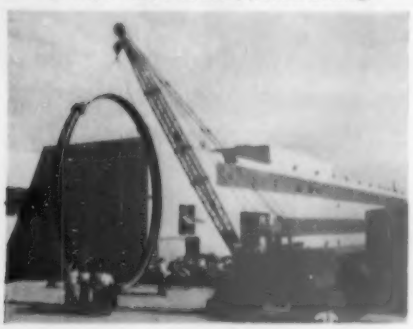
Solar's specialization in this field began with the development of the first stainless steel exhaust manifold for an aircraft engine in 1930. Since then Solar has continued to improve standard methods and pioneer new techniques to meet the increasingly exacting requirements of modern technology.

Production welding of all high temperature metals, including the high nickel and cobalt alloys as well as titanium and zirconium, is routine at Solar. Thicknesses from .002 to 4 inch are successfully processed.

Production facilities include metallic arc, fuel gas with oxygen, submerged arc, atomic hydrogen, automatic inert arc, and shielded inert gas metal arc. Proprietary techniques have been developed with special machines for buttwelding, seam leveling, tab tacking, and with special fluxes for alloy and aluminum welding.

For precision manufacture of welded products of the highest quality, consult Solar . . . complete services from prototype development to mass production.

The world's largest expansion joint required more than 10,000 linear inches of flawless welding.



SOLAR AIRCRAFT COMPANY — SAN DIEGO, DES MOINES

DESIGNERS, DEVELOPERS AND MANUFACTURERS OF METAL ALLOY PRODUCTS

This is What Solar Offers You

Solar specializes in the manufacture of precision products from alloys and special metals for severe service. Solar's experience since 1927 is unduplicated in this field. Solar skills and facilities range from research, design and development through to mass production. Wherever heat, corrosion or difficult specifications are problems, Solar can help you solve them.

PLANTS. *In San Diego (photo above) and Des Moines. A total of 1,400,000 sq. ft. of floor space. Approximately 5,000 employees. Annual sales over $65,000,000.*

EQUIPMENT. *Production equipment for all types of metal fabrication —forming, machining, welding, brazing, casting, coating. Extensive laboratory and testing equipment. Facilities for development, prototype, limited or mass production.*

SERVICES. *Research, design, development, tooling and production engineering staffs. Experienced with all alloy steels, stainless alloys, super alloys, and titanium and its alloys. Government source inspection and Solar quality control meet rigid aircraft and commercial standards.*

CONTRACT PRODUCTION

Current orders include aircraft engine and airframe parts, alloy castings, pneumatic ducting, atomic energy components. Customers include some of the most honored names among aircraft and industrial companies in the U.S. and Europe.

SPECIAL PRODUCTS

Bellows. *"Sola-Flex"® bellows and expansion joints in many designs from ½ in. up to the world's largest, 28 ft. in diameter.*

Gas Turbines. *Solar "Mars" 50 hp engines for auxiliary generator sets, ground carts, portable fire pumps; Solar "Jupiter" 500 hp engines in variable and constant speed models.*

Ceramic Coatings. *"Solaramic"® is the Solar trade mark for a family of coatings that protects metals from heat, corrosion, galling and abrasion.*

Controls. *Complete control systems utilizing the new Solar "Microjet"® principle for control of gas turbines, jet engines and pneumatic devices.*

FURTHER INFORMATION

Your inquiry regarding any Solar service or facility will receive prompt attention. Address Solar Aircraft Company, Department A-30, San Diego 12, California.

THE OIL AND GAS
JOURNAL
TULSA, OKLAHOMA

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JOURNALLY Speaking

Drilling Bits

THIS year our annual Drilling Contractors issue falls in Oil Progress Week, a coincidence which prompts us to dig down in our bottom drawer for miscellaneous bits of unauthenticated history of drilling which, by contrast with modern methods, suggest that considerable progress has been made in the drilling art through the years.

The drilling industry started in China a couple of centuries B.C. The Chinese used spring-pole rigs, bronze chisel bits, and bamboo casing and bailers. They were looking for salt water but sometimes they found gas, which they piped through bamboo lines and used in evaporating the brine. In United States today drillers look for gas but sometimes find salt water, which they don't use for anything.

Those benighted Chinese drilled many wells 1,500 ft. deep or more. It took them a long time, but time means nothing in the Orient. Sometimes a man would be drilling on a well spudded in by his grandfather. But they never struck oil. We have instances something like that in this country. In upstate New York a railroad worker has been drilling in granite for 13 years; he's down 860 ft., but his divining rod tells him to keep making hole. And near the California line in Arizona a farm family has been doing the same thing even longer.

Probably the cheapest fishing job in history was on a cable-tool job in northern Kentucky a generation ago. A mountaineer rode up on a mule to find out what was going on and was told something was lost down the hole. When he asked how deep he was told as deep as a tree, which is a driller's idea of a polite way of saying none of your business. The old hillbilly went away but about an hour later he came back with the mule dragging the lost drill bit and asked if that was what they were looking for. He was tickled to get $2 for his trouble because, he explained, the drill hadn't damaged the moonshine still he had in the cave the well had penetrated.

Even better was the beer well drilled in western Pennsylvania way back in the days when people would believe anything about the occurrence of underground fluids. The drill bit suddenly dropped several feet, and was brought to the surface dripping an amber fluid. Down went the bailer and came up full of cold, foaming beer. All work was suspended and the crew had a picnic. The operators figured this was better than oil, and predicted that they would put all breweries out of business. They did almost put one brewery out of business—the one that stored its beer in a big vat in a cave under the well site.

Jokes about fishing in oil wells are hoary, but there are several actual instances of wells that produced live fish. Mostly they were geophysical shot holes, a few hundred feet deep. One was in North Dakota, where the shot brought in a gusher of catfish, pike, and minnows up to 3 in. long. Only last year up in Alberta a similar shot hole yielded a big flood of 3-in. stickleback which attracted free-loading birds from miles around. A fish well was even brought in in the middle of the Sahara Desert, miles from any oasis. Apparently fish-bearing water actually occurs in underground pools and streams, as crude oil was once thought to but really doesn't.

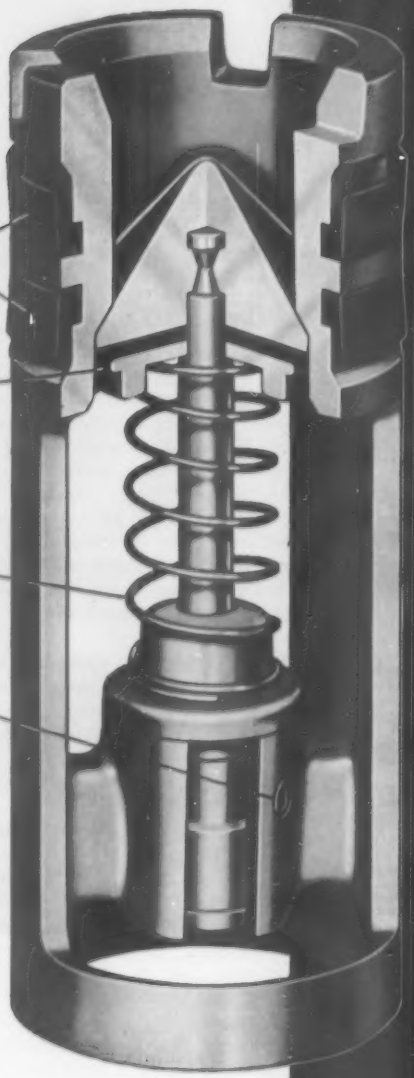
The industry's fiction is full of Paul Bunyanesque stories of mythical wells, but none of them beats the true story of a well that drilled itself in the early days of Cushing field in Oklahoma. The cable tools were lost soon after the pay was struck, and fishing was delayed while the well ran wild. But all the time there were sounds of pounding down hole. When the fish finally was caught it was discovered that formation gas had been lifting the bit and dropping it back, which deepened the hole and trebled its production.

It's things like that that make oil a fascinating business. Also an unpredictable one.

—Henry D. Ralph.

Now... better than ever...

Baker Drill Pipe Float Valve



SIDE SEALS REVERSED

to prevent distortion of seals by trapped fluid. Valve is easily removed.

MORE EFFECTIVE SEAL

The redesigned seal between the valve and the valve seat seals better—lasts longer—*stays in place* even under high circulating volumes and high pressures.

LESS SPRING TENSION

Reduces the cutting action of circulating fluid on the valve seal and seat.

GUIDE POSITIVELY ANCHORED

The valve guide is securely held in place by the set screw.

New!

BAKER MODEL "F" DRILL PIPE FLOAT VALVE

Baker Model "F" Drill Pipe Float Valve, Product No. 4813

Suggestions of drilling contractor and drilling department personnel have helped in redesigning and improving Baker Drill Pipe Floats so that they are *now better than ever*. They will save *you* time and money, muss and fuss, in every string.

POSITIONED WHERE DESIRED—A majority of operators install the Baker Drill Pipe Float Valve in a recess in the lower end of the drill collar where it is held in position by the pin on the drilling bit. Or the Valve can be positioned in a Drill Pipe Float BODY which serves as a tool joint sub at any point in the string.

EASILY INSTALLED AND SERVICED—The strong, simple Valve is made without threads and is merely dropped into place—or just as easily removed—by hand. No tools or wrenches are required. The inexpensive wearing parts are available at your supply store, and servicing is quickly and easily done right on the derrick floor.

The Baker Drill Pipe Float does so much; saves so much; and costs so little that we suggest you...

PICK ONE UP AT YOUR SUPPLY STORE—TODAY

BAKER

OIL TOOLS, INC.

HOUSTON • LOS ANGELES • NEW YORK

O.I.I.C. turns to the grass roots

IN its Oil Progress Week activities this year the petroleum industry is laying the groundwork for real progress in its efforts at better public understanding of its operation and its problems.

It is leaning far more heavily than ever before on service-station operators and the rank and file of company employes in all divisions to tell its story to the general public.

Too long the industry has been "talking to itself" through laudatory or defensive speeches at gatherings of other oil men. It has placed too much dependence on the power of the written word in general advertising.

THE BEST WAY TO SPREAD IDEAS is by word of mouth through casual remarks and informal conversations among neighbors or chance acquaintances. The greatest number of mouths available to spread words about oil belongs to people working in oil. What these people say about the oil industry is probably the biggest factor in what the general public thinks about it.

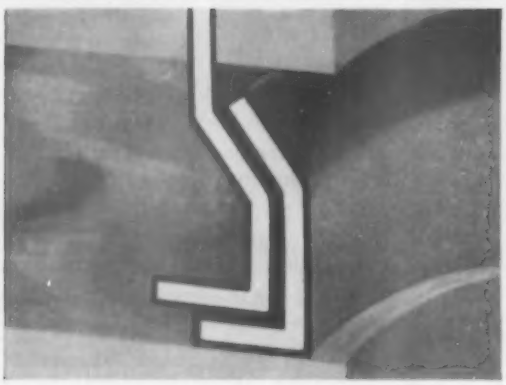
The public meets the oil industry at the gasoline pump, and the pump operator is the only oil man most people know. A good many have neighbors connected with the oil industry is some way but usually well below the policy-making level. It is through such human contacts that the public gets its impression of the oil business.

The industry's leaders are wise in recognizing that the problem of public relations is far broader than mere press relations, and in turning their attention to what the politicians call the grass roots. And in turning in this direction, the first discovery that the leaders made was that their own opinions were not, by any means, shared by all oil-company employes and station operators.

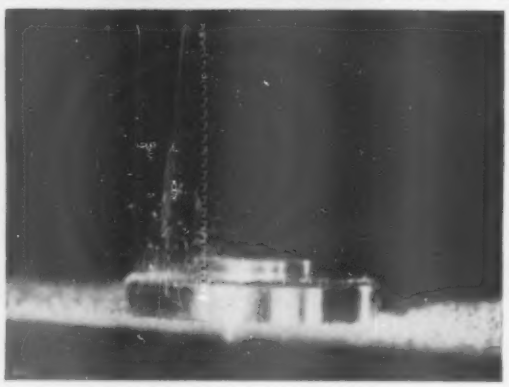
SO THE FIRST JOB IN BUILDING the foundation for better public relations is to educate the rank and file within the industry on how the business operates and what its problems are. Such folks can't simply be ordered to do missionary work for the front office on their own time. They must be given the facts on which to form their own conclusions. If these conclusions are right and are backed with sufficient conviction, the rest of the public-relations program will come easily.

It is a long, hard job, and an unglamorous one, to do this homework in our own back yards. It will take time, a variety of approaches, and a great deal of patience. But it will pay real dividends in internal morale as well as in external relations.

A long, hard job, this grass-roots business, but a sound one.



POSITIVE LABYRINTH. A joint is only as effective as its seal. Countless research studies have shown that the labyrinth is one of the most effective ways to seal a joint where at least one member rotates. Further sealing action is achieved by the film of grease that fills the minute clearance between the two seals.



FLINGER ACTION. One of the most important functions of the outer rotating seal is to throw off any foreign element that tries to enter the bearing. This flinger action is achieved by the centrifugal force set up by the rotating seal. Elements attacking the bearing are repelled.

Exclusive 4-way seal guards new Life-Line A bearing

Here's why you can count on reliable Life-Line A motor performance

There are three factors that affect motor bearing life: (1) type of lubricant, (2) amount of lubricant, and (3) presence of contaminants. The one *sure* way to control all three is to use a bearing that is pre-lubricated at the bearing manufacturer's plant and then SEALED.

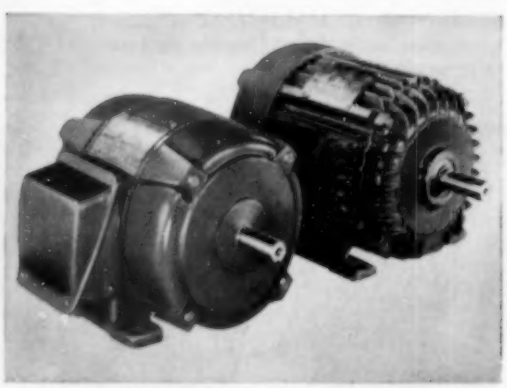
Many of the original Life-Line® pre-lubricated bearings installed in 1937 have been running ever since and are still like new. Now, Westinghouse offers another important step ahead... a pre-lubricated motor bearing that has *four* seals... two on each side. Here's real bearing protection. Grease is sealed in. Contaminants are sealed out. No on-the-job greasing is required—EVER.

This new concept in motor bearings is one of the many improvements Westinghouse has incorporated into the complete, balanced design system that makes the Life-Line "A" motor your best buy. Get all the facts from your local Westinghouse sales engineer. Or write for Booklet B-6154-A. Westinghouse Electric Corporation, 3 Gateway Center, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-21849

YOU CAN BE SURE... IF IT'S

Westinghouse

AIR BY-PASS. Totally-enclosed motors "breathe" as the internal air expands and contracts with change in temperature. Ordinary motors "breathe" along the shaft and through the bearings. Life-Line provides an air by-pass around the bearings to keep out contaminating air.



The performance of any motor is dependent on the performance of each component of that motor. It takes balanced design. That's why every component in the new Life-Line "A" motor has been redesigned and integrated with the whole. The result is a motor with superior performance and consistent dependability.

For Extra Sulphate Resistance

● Where sulphate attack is encountered, it takes a cement with special sulphate-resisting properties to protect casing against corrosion. That is why *extra* sulphate resistance is built into 'STARCOR' Oil-Well Cement and 'INCOR' Sulphate-Resistant Cement. What this means in resistance to sulphate action is shown by tests in Lone Star Oil-Well Cement Research Laboratory.

These bars of neat cement were photographed after exposure to a 4% sodium sulphate solution. The two bars, at left, made with cement without special inbuilt properties of sulphate resistance, show disintegration after 30 days—while the bar at right, made with cement with special sulphate-resisting properties, is unaffected after years of exposure.

For protection against the action of sulphate soils or waters, use 'STARCOR'* Oil-Well Cement or 'INCOR'* Sulphate-Resistant Cement. It pays to select cement to fit the job.

*Reg. U. S. Pat. Off.

Select Cement to Fit the Job!

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THIS WEEK... ...IN THE NEWS

THIRTY-FIRST SUCCESS in Pembina field for Socony-Vacuum and its associates is this operation 1½ miles south of the Pembina discovery. Only one well drilled by Socony in the Pembina area has been dry, and it was drilled to the north of Pembina field to test another anomaly. Shown here is the Pembina 4-14. Drilling was completed in the Cardium sand at 5,455 ft. shortly after this shot was made.

DRILLING—Study shows contracting industry is now at low point of its traditional cycle, with competition forcing companies to become more and more efficient to land contracts. . . . Footage per rig this year up nearly 10 per cent over 1953. . . . Even with 300 fewer rigs operating now than a year ago, both footage and completion records will be set. . . . ¶Rocky Mountain area records 3,009 completions during first 9 months, with year's total expected to be a new record of 4,400, up nearly 1,000 from 1953's 3,417. . . . ¶All outstanding stock of Arrow Drilling Co. sold to Canadian company headed by Robert B. Curran. . . .

EXPLORATION—One of the biggest gas-distillate strikes in recent years was reported in Winkler County, West Texas, by two independents, J. C. Barnes and C. V. Lyman. . . . The well had an initial daily potential of 2,424 bbl. of 58°-gravity oil and 160,000,000 cu. ft. of gas from the Ellenburger. . . . ¶Monterey Oil completes test from drilling island 1½ miles offshore as 300-bbl. producer. . . . Well flowed 26.4°-gravity crude through a 30/64-in. choke from 5,906-6,260 ft. . . . ¶Ohio Oil moves rig off world's deepest hole in Paloma field after hitting 21,482 ft. . . . Contract rig to be moved in, but well may be dry. . . . ¶Pure, Seaboard, Sun, and Ohio form offshore exploration team. . . . Pure, Ohio, and Sun form second group. . . .

NATURAL GAS—Federal Power Commission authorizes construction by American Louisiana Pipe Line Co. of 1,300-mile natural-gas system, with provision construction will not start until suppliers obtain FPC permits. . . . Similar restrictions included in certificate granted Texas Gas Transmission Corp. to build facilities to supply American Louisiana line. . . . ¶FPC issues first unconditional certificates to independent producers for sale of natural gas to pipeline companies. . . . ¶Committee is formed to push for legislation exempting production and gathering of natural gas from FPC control. . . .

PRICES—Stanolind Oil Purchasing sets $2.50 top in its first posting for North Dakota crude. . . . Action draws immediate protest from Amerada, state's principal producer. . . . Amerada's Jacobsen characterizes price as 40-cent "discrimination." . . . Stanolind says price was dictated by weak product markets in area plus fact other crudes in area are moving at much lower figure. . . . Posting followed dedication of new 30,000-bbl. refinery at Mandan and opening of new crude and products lines. . . . ¶Sohio Petroleum cuts Tri-State crude price 12 cents, meeting Ashland adjustment made in July and bringing area crude in line with Mid-Continent and North Texas crude. . . .

INTERNATIONAL—Cuba attracts new interest from two companies while a third firm reports no shows yet in its first wildcat there. . . . Kerr-McGee buys 25 per cent interest in concession covering new productive area. . . . Cuban-Canadian buys rights on surrounding acreage. . . . Nearby, Cuban American test passes potential pay zone without finding oil. . . . ¶Mexican Government stands firm on recent hike in price of Pemex gasoline. . . . ¶Brazil contracts for Venezuelan crude to feed new refinery. . . . ¶Oil shows reported at new wildcat in France. . . .

INDUSTRY—Five-year-old antitrust suit filed by Texas against 10 major oil companies appears headed for trial court. . . . State Supreme Court declined to grant writ of error regarding previous decision by Court of Civil Appeals, which ruled case should be tried before a jury. . . . ¶Merger of oil union with chemical workers may be delayed. . . .

Cost-cutting huddles explain . . .

COST CONFERENCE finds C. M. (Buzz) Lusk, seated, owner of P.L.D. Well Servicing Co., Houston, trying to find ways to increase efficiency of his seven rigs with his drilling superintendent, E. M. Davis. Scene is typical as contractors look for new ways to increase penetration rates and land new contracts.

Why We're Setting Records

. . . With fewer rotary rigs

Ted A. Armstrong

THE contract-drilling business is in the grip of a strange paradox: It has reached such a high peak of efficiency that many rigs are losing money.

Footage and completion records are being set; holes are being drilled faster than ever before; the most modern and efficient equipment is in the field. Yet, a third of the industry's rigs are idle, and an optimistic contractor is hard to find.

Not all of the industry's woes are self-imposed. In addition, it suffers from curtailment of development work in new fields, from a slackening of workover operations in old fields, and increased emphasis on offshore operations.

How can footage and completions soar when operating rigs number nearly 300 fewer than last year? There are many answers:

. . . **Use of the jet bit** has spread from its West Texas birthplace to reduce rig time in other areas.

. . . **Heavy drill-collar strings,** also tried first in West Texas, are now helping cut time in the Rocky Mountains and Gulf Coast.

. . . **Air drilling,** still limited in application, is more widely used now than at any time.

. . . **Faster moves** are being made as result of careful planning necessitated by tough competition.

. . . **More drilling** has been done this year in the softer-digging areas such as Illinois, Arkansas, Louisiana, and some areas of Colorado.

. . . **Better manpower** is now available. With fewer rigs running, the best crews are manning them, and the labor turnover is much slower.

There are other answers, but they boil down to one thing: Rig efficiency is at an all-time high. The average contractor this year is making 10 per cent more hole with each rig than he did in 1953. He has been forced to.

The compelling reason for the increased rig efficiency is competition. The contracting industry is at a low point of its traditional up-and-down cycle. There's a surplus of rigs, footage prices have dropped, and the contractor has had to figure ways of cutting drilling costs in order to make a profit.

The competition . . . "The romance has been taken out of contract drilling," one prominent Texas contractor said.

Everything is competitive, with a contract going to the bidder who has figured out how to cut the drilling time on a well.

"We're just like a bunch of road builders now," he continued. "The guy who can make a foot of hole the cheapest gets the contract."

It isn't altogether this bad. There are many cases in which the reputation of a contractor will give him a job, even at a little higher rate than the minimum bid. In some cases, a favored contractor is offered a job at a flat rate—usually the low bid offered by a competitor.

But, the situation is generally true. Prices are down, and the operating companies, while they are interested in seeing a healthy contracting industry, are taking advantage of the cheaper drilling.

"The only negotiated contracts now are in cases where we have an interest in the well and there is some obligation

to let us drill," a Louisiana contractor said. "In fact," he continued, "we lost a hole last week where the president and vice president are close friends of mine. Too, we had bid the rock-bottom low—a figure which had been the low rate in the area. But, apparently someone else just came in 25 cents lower."

What makes efficiency . . . In addition to the major factors involved in increased rig efficiency, there are several others. They include:

. . . Increased power. "We have increased our rate of penetration about 25 per cent in the past 2 or 3 years, and a lot of this is due to use of jet bits and at the same time compounding and paralleling pumps. We're also using bigger pumps," a West Texas contractor said.

. . . More automation. At least among the larger operators, the least efficient rigs have been stacked. With some exceptions, those remaining are the newest and best . . . and those with the latest automatic equipment to speed drilling.

. . . Reamers. In West Texas, particularly, some contractors are using reamers just above the bit to reduce the lateral drift when penetrating crooked-hole formations. The result is a straighter hole, drilled with less rig time.

. . . Water-base mud. The best way to save drilling time in West Texas, in the opinion of one medium-sized contractor, is to use water-base mud whenever feasible. "We find that using water down to 9,000 ft. in a 12,000-ft. hole will cut time tremendously. The biggest trouble is getting the companies to permit us to do it."

Success vs. difficulty . . . The individual contracting companies appear to fall into three classes:

. . . Those who know what is going on and have taken big steps toward meeting competition.

. . . Those who were late getting started but are under way on a program of increasing their rig efficiency.

. . . Those not prepared to meet the present low bids and who primarily are merely lamenting the rugged competition and hoping for better times soon.

One two-rig contractor is happy with the present situation. "We've found the success formula," he declared.

The formula: "Stay in a restricted area where your men know the problems and where moves are cheap." Also, he added, get good men and provide close supervision. Most contractors may not be able to place their rigs with such selectivity, but the formula apparently works. The two-rig company is one of the exclusive few in the industry which has all of its rigs working.

One company with only one of its seven rigs running fits the second category. The company was a partnership until recently, and the partners were split on the question of operating with minimum rig repair or modernizing them as attention was needed. Nothing was done, and the company became less and less able to land contracts.

"We've lost our other partner and are now under way on a program of making our rigs just as efficient as we can get them," the remaining owner said.

An example of the third class of company is another Texas contractor with more than 10 rigs and only two running.

"We are in a position that we don't have to keep them running. When prices get too low, we just stack them rather than operate at a loss," the manager said.

The outlook . . . There is considerable pessimism among contractors, a part of which is normal and a part of which reflects apprehension.

"I see no reason to expect a pickup in activity in the next 6 months," declared a former official of the American Association of Oilwell Drilling Contractors. "We're now about as efficient as we can get, and if the competition gets any worse, someone is going to get hurt."

Other contractors generally express the same belief. The future may not be so bad, however, as many fear.

For one thing, drilling activity normally picks up toward the end of the year as companies act to meet lease commitments or use up remaining funds in their drilling budget.

Too, anything like a normal winter is expected to bring a substantial increase in product demand—and therefore crude demand—in the first quarter. While demand and rig activity cannot be correlated too closely, a more optimistic attitude toward development drilling is expected within the operating companies as demand strengthens.

Even without any substantial increase in production in the near future, drilling records apparently will be broken this year. It was anticipated at midyear that development drilling would be off during the last 6 months but that even with the last-half lag the industry in 1954 would complete a record 51,540 wells and establish a footage record of 213,704,000 ft. *(The Oil and Gas Journal, July 26, page 154).*

With only 3 months to go, the industry is figuring that with an average of 860 completions a week these figures will be reached.

Drilling activity began its gradual decline this year at the end of April. The drop was accelerated during July, but activity has leveled off since the first of September and is expected to climb rather sharply after December 1.

Industry complaints . . . The biggest share of the blame for current low prices is laid by contractors generally on the "price cutters."

"When a guy cuts his prices but can still drill the hole and come out all right, we don't consider that price cutting," one contractor explained. "What hurts, though, is for a small contractor with big monthly payments on his rig to bid below the cost of drilling just to keep his rig active and his crews paid."

Other complaints are that:

. . . Oil companies, both majors and independents, have cut down on their drilling programs. One major is reported to have ceased all but required development work and switched remaining drilling funds into a refinery-expansion program.

. . . Workover operations have been sidetracked. Low allowables and low demand have made it pointless to rework many producing wells, even though they need it, some say.

. . . Imports of foreign oil, many contractors contend, are basically responsible for the limited production and, therefore, the drop in drilling activity.

Facts and figures . . . It is estimated that there are about 3,600 rotary rigs available for duty in the United States, including marginal equipment.

Of this total, only about 2,350 are now operating. This is in sharp contrast with the 3,020 rigs making hole on December 10, 1951, when Spraberry development sent rig activity to an all-time high. The 1951 figure included only those rigs which were rigged up and drilling. Those moving, rigging up, or waiting on cement brought the total number of active rigs probably to around 3,300.

Spraberry was about the rosiest period in recent years for the contractor, and it helped to create the current situation.

"Every car dealer with money in the bank bought a rig and got in the business then," one Midland contractor lamented.

But, as bad as the situation now is, the contractors agree, it could get even tougher. As a Houston vice president put it:

"In 1942 we had 1,800 rigs and only 700 operating. Things were a lot worse then."

Important Strike Made

Midland independents get distillate flow of 2,424 bbl. daily in deep West Texas test; boost in activity seen

Carl Hoot

KERMIT, Tex.—One of the biggest gas-distillate strikes in recent years has been completed in Winkler County, West Texas, by J. C. Barnes and C. V. Lyman, Midland independents.

The well, the 1 Kerr, had an initial daily potential of 2,424 bbl. of 58°-gravity oil and 160,000,000 cu. ft. of gas from the Ellenburger. The well is also significant because of its location along the western edge of the Central Basin Platform fields. It will undoubtedly initiate a succession of similar deep wildcats all along this trend of fields.

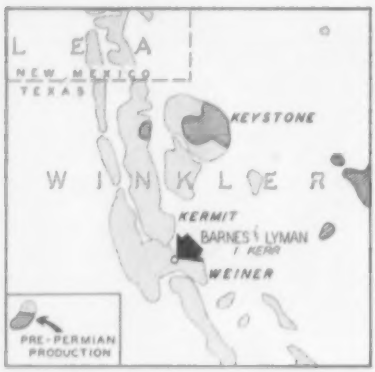
No. 1 Kerr is situated 5 miles south of Kermit, within the Emperor (Permian) field. Emperor is one of the old producing areas in what is known as the "Sand Belt" trend, and this trend extends from Monument field in southeastern Lea County, New Mexico, to Pecos Valley fields in northwestern Pecos County, West Texas.

The few deep tests in this 150-mile-long area have been widely scattered. Last year a Devonian discovery in Payton field, 34 miles to the south of 1 Kerr, opened deep production in that area and several wells were drilled which produced high-gravity distillate along with gas volumes in excess of 100,000,000 cu. ft. daily.

Ellenburger surprise . . . Completion in the Ellenburger at 1 Kerr came as a surprise to the industry. Drill-stem tests in the Devonian over an indicated 179-ft. pay section between 8,990-9,202 ft. developed gas flows up to 30,000,000 cu. ft. daily under 4,000 psi. flowing pressure, and recovery on the tests included small amounts of distillate.

Preliminary drill-stem tests in the Ellenburger, from the formation top at 11,430 ft., were disappointing, but one test produced gas at the rate of 5,500,000 cu. ft. daily. Final perforations in the Ellenburger were at 11,480-11,525 ft. and were treated with 500 gal. of mud acid. Choke size on completion test was 20/64-in.

Deep drilling along this trend of sand fields has been delayed for good reasons. Operators have been occupied with intense development of the Permian and pre-Permian pays up and down the trend. Too, the big pre-Permian search initiated within recent years has been concentrated east of the platform and in the western half of the Midland basin.



Nearest pre-Permian production to 1 Kerr is in Keystone field, which has both Devonian and Ellenburger production and lies about 10 miles to the northeast.

Stanotex Stringing Pipe

HOUSTON.—Standard Oil Co. of Texas has started stringing pipe for its 6-in., 248-mile common-carrier products line from El Paso to Albuquerque.

Pipe was being placed at both ends of the project, but Standard of Texas said last week that it had not yet awarded the actual construction contracts.

The line will move 5,000 bbl. daily of finished products from the El Paso refining area to the Albuquerque metropolitan area, which is now supplied only by tank car. Cost of the line will be more than $4,000,000. It will have one pumping station initially.

Texas Presses FPC Fight

AUSTIN.—John Ben Shepperd, Texas attorney general, has filed a supplemental petition for a rehearing of the so-called Phillips case decision of the U. S. Supreme Court.

Shepperd contended in the petition that Order 174-A issued by the Federal Power Commission on the basis of the court's ruling overrides Texas' conservation powers. He cited examples of conflicts in Texas natural-gas fields where "independent producers who attempt to comply with conservation rules of the Railroad Commission must secure prior approval from FPC."

He said that under the new holding an independent producer "must be prepared to serve at least two masters and perhaps three."

"He must obey the orders of the FPC, he must comply with state conservation regulations, and he may have to answer to federal prosecution for violation of allowable production," Shepperd said.

Quintana Unit OK'd

Pressure-maintenance set for East Long Mott field

AUSTIN.—Quintana Petroleum Corp. has the go-ahead from the Texas Railroad Commission to proceed with a unitization and pressure-maintenance project in East Long Mott field, Calhoun County, Texas Gulf Coast, which would recover an estimated 2,570,000 bbl. of additional oil from the Frio formation.

The field takes in 1,000 productive acres and 32 wells. Salt water will be injected around the perimeter of the field in an open-type system. Water injection may be supplemented by gas injection.

East Long Mott had produced almost 2,200,000 bbl. of 42°-gravity crude at the first of the year and is estimated by Quintana engineers to be 80 to 90 per cent depleted under primary means of production. It was discovered in 1948.

Reservoir energy has been primarily solution gas with some help from expansion of small gas caps. Oil and gas occurs in closures against dual faulting. Five fault segments have been proved productive.

Boyd To Speak at Dallas

DALLAS. — Dr. James Boyd, exploration manager of Kennecot Copper Corp., Denver, and former director of the U. S. Bureau of Mines, will speak at the eighth annual midwestern meeting of the Society of Exploration Geophysicists to be held here November 18.

Dr. Boyd was a pioneer in developing instruments for geophysical exploration. He was director of the Bureau of Mines from 1947 to 1951 and served as administrator of the Defense Minerals Administration in 1950 and 1951.

Gas Line Approved

FPC rules in split decision, however, that 1,300-mile project can't begin until producers get certificates

Bertram F. Linz

WASHINGTON. — The 1,300-mile natural-gas pipeline projected by American Louisiana Pipe Line Co. from North Tepetate, La., to Bridgman and Detroit, Mich., has been approved by the Federal Power Commission, but there are some strings attached.

Construction cannot begin until the independent producers who are to supply the gas have applied for and obtained FPC authorization.

A similar restriction was incorporated in a certificate granted the Texas Gas Transmission Corp. to build facilities to supply American Louisiana with part of its gas requirements.

The commission worked overtime to reach a decision on these applications September 30 in hope of beating a deadline in the gas purchase contracts giving the sellers the right to terminate them on or after October 1 unless American Louisiana notified them it had secured a FPC certificate.

The natural-gas producers had previously stymied American Louisiana's bid for the line by expressing a reluctance to file for FPC certificates under Order 174-A. The FPC at one time indefinitely postponed further hearings on the line after being told by counsel for the company that suppliers would not file for the certificates unless legally required to *(The Oil and Gas Journal, September 20, page 140)*.

Arguments . . . In a dissenting opinion, however, Chairman Jerome K. Kuykendall and Commisisoner Seaborn L. Digby argued the commission should have stuck by its rule that producers' applications to sell must accompany a pipeline company's showing of supply. There was no proof, they declared, that American Louisiana's suppliers are able and willing to supply the gas. Two suppliers, representing about 25 per cent of the gas the company had contracted for, have indicated that they consider their contracts ended.

In its majority opinion, the commission pointed out that "clearly," except for the Supreme Court decision in the Phillips case, "American Louisiana and Texas Gas would at this time be granted the certificates which they seek, subject only to the conditions as to allocation of gas, rates, and financing provided herein."

Under the court decision, the commission adopted its rules for regulating producers' sales and provided an October 1 deadline for filing applications. But, the deadline has been extended to December 1 and, the majority said, there is no valid reason for requiring American Louisiana's producers to file their applications at an earlier date.

Added restrictions . . . Other conditions leave for future consideration the deliveries and sales of gas to be made by American Louisiana and authorization for the construction of a 117-mile, 22-in. segment of the system; limit American Louisiana to the transport and sale of no more than 111,946,000 M.c.f. at 14.73 psia. per year; call for the filing of a satisfactory schedule of rates not less than 60 days prior to commencement of service, and require the filing of a satisfactory plan of financing at least 30 days prior to commencement of construction of the facilities authorized.

Conditions in the certificate to Texas Gas limit delivery and sale to American Louisiana on a firm basis to 18,615,000 M.c.f. at 14.73 psia. per year, prohibit the construction of any of the facilities authorized until American Louisiana had filed applications to supply gas sufficient to support its project, and call for the filing of a rate schedule at least 60 days prior to the commencement of service.

Plans of system . . . The American Louisiana project calls for the construction of about 1,172 miles of pipe-

The Majority's View . . .

"American Louisiana's gas purchase contracts provide that the sellers shall have the right to terminate same on or after October 1, 1954 unless America Louisiana shall have notified sellers that it has secured a certificate of public convenience and necessity from this commission.

"In the event such a certificate is not issued prior to October 1, 1954, that alone, in spite of the fact that American Louisiana's project is otherwise feasible, might well result in a failure of the project. This would deprive the consuming public in the area to be served of the much needed gas which American Louisiana proposes to provide.

"It appears from the uncontradicted evidence in these proceedings that there is a crying demand for additional quantities of natural gas in the Michigan-Wisconsin area which, if not satisfied by the American Louisiana project, may not be satisfied for a considerable period of time.

"We do not believe that it would be consistent with our responsibilities, during this transitional period resulting from the Phillips decision, and in view of the large unsatisfied demand for natural gas in the area to be served, for us to adopt any procedure for enforcing the mandate of the Phillips decision, which might result in a collapse of the American Louisiana project to the detriment of the public welfare."

Dissenters' Objections . . .

"Obviously, simultaneous filing was not possible in this instance, but that does not mean that no filing at all by the independent producers is or should be required before a certificate is issued . . .

"We would not require strict and unreasonable adherence to this rule during this period of transition and unsettled conditions in the natural-gas industry . . . if we had any satisfactory proof that American Louisiana's suppliers are able and willing to do what must be done, in order to enable American Louisiana to do what it proposes to do. But this proof is wholly lacking . . .

"We are not at all convinced of the soundness of the argument that the applicant must have a certificate by October 1, 1954, in order to be able to hold its suppliers to their contracts. If the suppliers, by their own conduct, have prevented the applicant from performing under its contracts with them, then they, the suppliers, cannot escape their contractual responsibility by claiming the applicant has defaulted. Hence, the October 1 deadline, which may have existed prior to the Phillips decision, has now been erased. We do not even find it necessary, at this time, to impose another deadline on American Louisiana producers, as the majority has done."

line between North Tepetate, La., and a terminus at Detroit. The 117-mile line would run from near Payne, Ohio, to the Bridgman, Mich., area. It was eliminated from the certificate pending conclusion of proceedings on related applications by Michigan-Wisconsin Pipe Line Co. and Michigan Consolidated Gas Co., both American Louisiana affiliates. Cost will be $130,700,000 and initial capacity will be approximately 300,000 M.c.f. daily.

The Texas Gas Transmission Corp. part of the project calls for construction of about 48 miles of pipeline paralleling sections of its existing system between its Lake Cormorant, Miss., compressor station and its station at Slaughter, Ky. This project would cost $4,281,135, and Texas Gas would supply American Louisiana with an average of 51,000 M.c.f. of gas daily.

American Louisiana plans to supply 100,000 M.c.f. daily to Michigan-Wisconsin and 200,000 M.c.f. per day to Michigan Consolidated.

FPC Issues Certificates

Delta, Mayfield get permits to sell gas under new order; rate increase suspended; pipeline firm files complaints

WASHINGTON.—The Federal Power Commission has granted its first unconditional certificates for the sale of natural gas to pipeline companies by independent producers.

It also has issued its first suspension of a rate increase under Order 174-A and received its first complaints of threatened cancellation of a supply contract under that order.

Sale certificates . . . Delta Drilling Co., Tyler, Tex., received a certificate to sell gas from Epps field in East and West Carroll parishes, Louisiana, to Southern Natural Gas Co., and M. L. Mayfield, Houston, received a certificate to sell gas from Pine Prairie field in Evangeline Parish, Louisiana, to United Fuel Gas Co. through the facilities of Gulf Interstate Gas Co.

Rate order . . . The suspension order went to Phillips Petroleum Co. to stop changes in the method of computing reimbursements for the Texas production tax and for escalations in its basic rate contracts involving approximately $805,300 a year. The company has been permitted to file proposed rate increases based on payment of the producing tax, which went into effect September 1. The tax amounts to about $144,700 a year.

Complaints . . . Two complaints seeking to restrain suppliers from terminating gas sales contracts under their escape clauses were filed with the FPC by the Texas Illinois Natural Gas Pipeline Co.

The company reported it had received 30-day termination notices from 14 producers in the Clayton and La Gloria gas fields in Texas. The notices are based on provisions in the contracts that they could be terminated if the FPC imposes regulation upon the sellers in respect to the production, gathering, processing, and sale of natural gas.

Most of the termination notices were dated early in September, when it appeared that applications for certificates to sell would have to be filed by October 1. However, they indicated that the producers would continue deliveries pending the final determination of the commission's orders prescribing regulations to govern independent producers.

Texas Illinois named Argo Oil Corp. and Magnolia Petroleum Co. in its complaint covering the Clayton field. The complaint covering the La Gloria field names the same companies along with Brown & Wheeler, Continental Oil Co., Fidelity Oil & Royalty Co., Mound Co., R. A. Welch, La Gloria Oil & Gas Co., Ohio Oil Co., Phillips Drilling Corp., Irene Sheerin, C. C. Small, Binford Arney, James Lawrence Sheerin, Robert Malcolm Sheerin, Sun Oil Co., and Wiltex Corp.

Pipeline Shipments Rise

WASHINGTON. — Pipeline transportation of petroleum products has more than doubled and shipments of crude oil by pipeline have increased approximately 50 per cent since 1947, Interstate Commerce Commission figures indicate.

Data compiled by the ICC from reports of pipeline companies subject to its jurisdiction show that 507,845,083 bbl. of refined oils had trunk-line movement last year compared with 245,161,310 bbl. in 1947. Crude moved by trunk line rose from 1,797,969,737 bbl. in 1947 to 2,596,578,447 in 1953.

At the close of 1953 the reporting companies operated 50,031 miles of gathering lines and 83,870 miles of trunk lines, compared with 45,909 and 73,389 miles, respectively, in 1947.

Plant Gets Writeoff

Butadiene, alkylate project will be built near Houston

WASHINGTON.—Accelerated amortization for a $30,000,000 aviation-alkylate and butadiene plant was granted last week to Texas Butadiene & Chemical Corp.

The announcement also disclosed that the plant, which will compete with the government-owned synthetic-rubber plants now up for sale, will be built on the eastern outskirts of Houston.

The grant was one of the largest yet made, permitting rapid writeoff of 100 per cent of $24,759,000; 45 per cent of $3,420,000; and 15 per cent of $140,000. The large amount given 100 per cent rapid amortization reflects the Government's desire to boost avgas alkylate capacity in this country. The proposed plant's capacity for producing 5,000 bbl. per day of alkylate brings the Government close to its current goal.

Texas Butadiene will be the first operation of its kind. It will be based completely on butane. It will employ three principal processes—dehydrogenation, isomerization, and alkylation.

Process plans . . . Although definite decisions have not yet been reached as to licensors, it is generally believed that Houdry Process Corp.'s dehydrogenation process will be used to convert butane to both butylenes and butadiene.

A fraction of the normal butane feed will be converted to isobutane in an isomerization unit, possibly the liquid or vapor-phase processes licensed by Shell Development Co.

Butylenes and isobutane will then be combined in an alkylation unit to produce finished avgas component.

The company has not yet revealed whether it will use the sulfuric acid or hydrofluoric acid process. Plant design will permit flexibility for maximizing either butadiene or alkylate yields.

The plant location was given as Settegast, Tex., just outside the eastern city limits of Houston.

Warren Petroleum Corp. is scheduled to supply butane to the new plant, and construction will be handled by Fluor Corp. *(The Oil and Gas Journal, July 19, page 75).*

Rubber Deals Pushed

WASHINGTON.—A tentative draft of a contract for sale of the government-owned synthetic rubber plants has been mailed each bidder by the Rubber Producing Facilities Disposal Commis-

sion in an effort to expedite the sale.

The commission is scheduled to close the contracts by December 27.

The contract spells out in detail the legal procedure by which the properties will pass from government to private ownership. Copies went to the 35 organizations which submitted 75 different proposals for the properties. *(The Oil and Gas Journal, June 7, page 63).*

The commission's action in mailing copies of the contract to bidders would appear to indicate it is still confident of being able to dispose of the facilities despite reports that original offers were too low to be satisfactory. The return from the properties at fair and reasonable prices was estimated by Congress at $300,000,000 to $350,000,000.

In some rubber circles the belief is held that the commission will sell the synthetic facilities if it can get anything near minimum estimate.

Fuel Imports Cut Asked

WASHINGTON. — A presidential directive to cut imports of residual fuel oil until Congress can enact quota legislation is being pressed by the bituminous-coal industry.

The recommendation for restrictions on imports was offered by an industry committee in a brief filed with an interdepartmental committee which is studying the coal problem.

The coal industry brief asserted that voluntary curbs on imports of oil have not been successful in solving the problem of coal-oil competition.

State Department views on fuel-oil imports also were submitted to the committee. Although details of the report were not disclosed, the department is understood to take the position that foreign residual has been a minor factor in reducing demand for coal.

Arbitrary curbs on the importation of oil have consistently been opposed by the department as infringing upon the administration's foreign-trade policy.

Hoover Takes Oath

WASHINGTON.—Herbert Hoover, Jr., whose efforts as special advisor to the State Department contributed largely to the recent settlement of the Iranian oil problem, was sworn in as Undersecretary of State October 4.

As second top-ranking official of the department, Hoover will continue to be involved in international oil problems which may arise. His acceptance last year of appointment as special adviser to the secretary on oil matters was his first venture in governmental affairs, and his appointment as undersecretary was made despite his disclaimer of political ambition.

WATCHING WASHINGTON

Bertram F. Linz

FPC Member Disagrees

Some of the newly won power of the Federal Power Commission is being challenged by one of the commissioners.

Commissioner Seaborn L. Digby questions the commission's authority to issue certificates for construction of facilities needed by independent producers to deliver natural gas to interstate pipelines.

The question arose when the commission, in issuing certificates to producers authorizing sales also authorized the construction of "whatever facilities" subject to FPC jurisdiction may be necessary to consummate the sales.

Digby protested that Congress never granted the FPC the power to regulate independent producers' facilities and that the commission apparently recognized that fact in Orders No. 174 and 174-A.

Many people feel that the FPC hedged in adding the "whatever" facilities phrase. If the controversy should be brought before the courts, there now should be no question as to what the commission meant.

It is pointed out that any decision giving the commission authority over producer sales, whether by the commission, Congress, or the courts, may raise questions involving the regulation of such facilities as gathering lines.

Merger Points Revealed

The Justice Department for the first time has made known how it determines whether mergers of big corporations violate the antitrust laws.

The department has never disclosed whether it has been asked to pass on mergers in the oil industry, but if the matter ever arises, here are some of the considerations that will be involved:

Competition . . . The fact that the merging companies may not be in competition with each other is not held to be pertinent, but their relative position in the industry, individually and combined, is.

Size . . . Also considered are the location, physical and financial size, past acquisitions, products and activities of the merging companies, individually and combined.

Miscellaneous . . . Other factors are the structure and size of the industry in terms of production and capacity; the ease with which new competitors may enter; the number of companies active in the industry and their respective size and relative standing in sales and total assets; and the sales, relative standing and like factors of the merging companies and their competitors in definable market areas, if relevant.

On the basis of these factors, the department will determine the effect the proposed merger may have on sources of raw materials, and methods and patterns of distribution; whether the acquisition may result in a significant reduction in competition; whether it may increase the relative size of the purchasing company so as to give it a substantial advantage over its competitors; and whether it might result in a lessening of competition.

GSA Decision Protested

Independent producers are still unhappy with the General Service Administration.

The GSA last month cut the number of exemptions from provisions of the Buy-American Act, but the independents are not happy over the way the matter was handled by Administrator Edmund F. Mansure in a public announcement September 17 *(The Oil and Gas Journal, September 27, page 45).*

While the producers are encouraged by the limitation of the exemption to the eastern states, it was explained by Russell B. Brown, general counsel of the association, that there is no basis for its application even in that area.

The September 17 order, Brown said in a letter to Mansure, is based upon findings "entirely inconsistent" with the Buy-American Act, and there is no ground for a decision that it would be "'impracticable" to fill government requirements in the exempt area from domestic supplies.

With the issue thus kept alive by Brown's protest there's a good chance that Rep. John Jarman of Oklahoma, who has been waging a running fight on the GSA from the capitol, will press for a congressional investigation when Congress convenes in January.

Reservoir Problem

Migration and mixing of oil and water in Elk Hills field has caused some oil loss, but the problem is being solved

D. H. Stormont

LOS ANGELES.—It's hard to keep oil and water in their respective places in a partly depleted oil reservoir when you quit making withdrawals, the U. S. Navy is learning.

The shallow zone in California's Elk Hills field is a case in point.

Here the Navy Department has built up a large productive capacity, which it is holding against a possible national emergency. Large pressure differences, however, tend to cause some oil to migrate down structure into water-saturated areas and cause water to invade oil sands and prevent the oil's recovery.

The situation may have resulted in the loss of millions of barrels of oil, members of the American Institute of Mining and Metallurgical Engineers were told at the October 7-8 meeting here of the Pacific petroleum chapter. Authors of the paper were F. W. Gooch, Jr., of the Navy, and R. H. Adams, of Standard Oil Co. of California, which operates the petroleum reserve for the Navy.

Largest reserve . . . The Navy's readiness program has made the field the state's largest petroleum reserve. Its current productive capacity is well in excess of 100,000 bbl. daily for a sustained period, the authors said.

They estimated total recoverable reserves at 730,000,000 bbl. Of this, 330,000,000 bbl. are in the shallow zone and 400,000,000 bbl. in the virgin Stevens zone. No estimate was made of the recoverable oil in the still deeper Carneros reservoir, a condensate producing horizon known to extend over a large area but in which only two wells have been completed.

Only five producers had been completed in the Stevens zone at the end of 1945. Since then 220 more have been completed to essentially complete development of this zone. Spacing pattern was one well to 80 acres in areas where the sand is thin or made up of fractured shale, and one well to 40 acres in the thick sands. Aside from periodic testing none of the new wells has been produced.

Shallow zone problems . . . During World War II the shallow zone produced 27,000,000 bbl. of crude, the authors brought out, with withdrawals reaching as much as 65,000 bbl. daily When it was closed in during late 1945 the reservoir was in an unbalanced state due to these high withdrawal rates.

Realizing this, a pressure-maintenance program was started in an attempt to retard the advancing edgewater. By June 1952 it was evident the project was not stopping water encroachment on the north flank. Adverse pressure gradients had been increased so that an estimated 2,000,000 bbl. of fluid was moving annually downdip into water-bearing sands. Gas injection thus was suspended.

An experiment to create a natural water drive by down-flank injection likewise proved unsuccessful. Oil was being bypassed and rendered unrecoverable, and this project likewise was abandoned.

After studying the situation for a year, the problem was attacked in June 1953 from the reverse angle. Water was calculated to be moving into the north and east flanks of the zone at a rate of 34,860 bbl. daily. Enough wells therefore were placed on production in the invaded area to withdraw fluid at least equal to this rate of influx. Present studies indicate the program is working quite well. Of the 21 sand areas affected by the program, water encroachment now is controlled in all but eight.

Gooch and Adams said progress is being made on the south flank, where oil had been migrating down structure into water sands. Lowering of the reservoir pressures in the gas-cap areas, combined with all down structure wells

Deep Wildcat in West Virginia

Drilling passed the 8,200-ft. mark last week at this West Virginia wildcat, which is expected to become the deepest well ever drilled in the state. Located in Wood County 16 miles east of Parkersburg, the test is being drilled by Falcon Seaboard Drilling Co., Tulsa, for Hope Natural Gas Co., Seaboard moved a big rotary rig from western Oklahoma to complete the well, which had been drilled to about 4,300 ft. with cable tools. Projected depth is 12,000 ft. Deepest well in the state is a Hope test drilled to 10,018 ft. in 1941.

being placed on production, has substantially halted this movement.

Stevens problems . . . Since the Stevens zone has produced only minor quantities of crude, keeping it "mothballed" has caused no loss of oil through migration. The readiness program being followed, however, is causing problems.

Periodic studies have shown that abnormally high fluid gradients accumulate in the tubing of shut-in wells. Sampling showed the foreign materials to include drilling mud and water in varying amounts. As experience in other fields has showed that water standing against a Stevens zone sand is harmful to its productivity, a purging program was instituted. This calls for periodic production of the shutin wells at flow rates exceeding 500 bbl. per day.

Drain Holes Effective

Lateral drilling is described as significant factor in boosting output of wells under certain conditions

LOS ANGELES.—Addition of drain holes in oil wells for the purpose of increasing their productivity is theoretically sound, according to model studies carried out by California Research Corp.

The laboratory studies, described by R. L. Perrine of Cal Research before the annual meeting of the A.I.M.E. Pacific petroleum chapter here last week, showed that significant increases in production should be obtained. The amount produced in the studies was governed by the length, number, and arrangement of the laterals, by thickness of the oil sand, and whether the formation was damaged near the well bore.

If there was a zone of reduced permeability around the well bore, he found that productivity might be substantially increased—such as by a factor of 10. Under conditions considered in the study, the increase for undamaged productivity ranged about 2½ times that which would result from a conventional well. *(How drain holes are being used in remedial work is discussed on page 144).*

Length important . . . Using an electrolytic tank model as an oil reservoir, Perrine found that the distance to which drain holes penetrate is of primary importance. In contrast to some means of improving productivity, drain holes must extend an appreciable distance beyond a damaged zone in order to overcome the effects of damage.

Number of drain holes, while of importance, was found to be secondary to length.

Arrangement of the laterals was found to be of little importance as far as productivity is concerned for holes extending 40 to 60 ft. from the well. Best arrangement must be decided on the basis of the individual well, he declared.

Effect of drain holes on decline rate and well spacing were not included in the studies. "A decision as to the practicality of drain holes, or a decision as to how they should be used, can only be made on the basis of the particular well under consideration," Perrine explained.

Production rate . . . Increase in productivity, up to a point, is nearly proportional to the combined length of all drain holes drilled into the formation.

"Beyond this point, the additional productivity increase per foot of added drain-hole length diminishes," Perrine said. "For the conditions assumed in this study, 2 to 4 ft. of combined drain hole length per foot of formation thickness appears most readily justified. More than 4 ft. appears justified only where the additional cost is low, or where damage has reduced productivity and permits additional improvement to be obtained.

"A total of 2 ft. of drain hole length for each 1 ft. of net sand thickness may result in a productivity about 1.7 times as large as that for the undamaged formation. Thus the additional production provided by drain holes is 0.7 times that for the undamaged formation, or a 70-bbl. per day increase might be expected from an undamaged 100-bbl. well. A productivity about 2.1 times that of the undamaged formation should result from 4 ft. of drain hole length per 1 ft. of formation. Doubling the drain-hole length would therefore contribute only another 40 bbl. per day to production."

Conclusion substantiated . . . In a second address delivered at the half-day forum, the application and mechanics of drain-hole drilling were described by C. William Zublin, Universal Engineering Co. Experience gained in providing some 130 wells with drain holes have shown the method to be fundamentally sound, he declared. He added that it should be realized, however, that "drainholing is not a cure-all for every production ailment of the petroleum industry."

Island Test Hits

Monterey brings in 300-bbl. producer off Seal Beach

LONG BEACH.—Monterey Oil Co. has completed the first test from its drilling island 1½ miles offshore from Seal Beach as a 300-bbl. producer.

The well flowed 26.4°-gravity oil from a depth of 5,906-6,280 ft. Choke size on the test was 30/64-in. During a 3-day test period a tubing pressure of 100 psi. and a casing pressure of 750 psi. were registered.

The well has been shut in pending installation of facilities to receive and transport the crude to shore.

Monterey officials did not identify the producing zone. Field reports credit it as being the equivalent of the Ford zone in Wilmington field, 4½ miles northwest. The company's first producer on the 1,280-acre lease, jointly held with The Texas Co., was bottomed at a vertical depth of approximately 5,700 ft. after drilling seaward 9,271 ft. from an upland location. The new producer is located about 800 ft. seaward from the bottom of the slant hole. The latter has been producing about 30 bbl. daily since 1947.

Basement was anticipated at depths at 7,000 to 9,000 ft., but the exploratory well drilled vertically to 10,162 ft. without finding it. The rig's capacity kept Monterey from carrying the hole deeper. The company did not disclose whether it found the Ranger and Terminal zones productive.

A second test was being spudded last week, an announcement by E. E. Pyles, Monterey vice president, said. It will be a slant hole. Monterey originally planned three wildcats from the island, one vertical and two slanted holes.

How many other holes will be drilled from the 75-ft. diameter earth-filled structure has not yet been determined, Pyles said, adding that at least 8 or 10 could be drilled safely.

Union Asks Pipeline Bids

LOS ANGELES.—Union Oil Co. has asked for bids on a 65-mile, $4,000,000 pipeline from its Torrey Canyon field near Santa Paula to its refinery here. Awarding of contracts for the 12-in. crude carrier is expected in about 2 weeks. Work on the pipe-

line is expected to start before November 1. Completion is scheduled for April of next year. Route of the carrier will be generally south from the field through the Santa Susana and Santa Monica mountains to the company's Torrance tank farm, and then to the Los Angeles refinery.

Union's increasing production in several Santa Clara Valley fields dictated construction of the line to replace tankers now moving crude from its Ventura marine terminal. The company's current crude output is about 10,500 bbl. daily. In addition, the company purchases in the Ventura, Santa Paula, and Del Valle fields.

Capacity of the line initially will be 50,000 bbl. daily with only the Torrey Canyon station operating. Addition of a booster station will increase its capacity to 70,000 bbl. daily.

For small gas volumes...

...New Absorber Valuable

D. H. Stormont

LOS ANGELES.—Crude oil sometimes can be used quite advantageously for absorbing most of the butanes and heavier hydrocarbons from wet field gas, members of the California Natural Gasoline Association were told at their annual fall meeting here October 7-8.

The method lacks the conventional absorption plant's efficiency, but because of its much lower installation and operating costs the crude-oil plant often can earn more profit.

Other advantages stressed by the speaker, J. A. Gordon of Union Oil Co., included lessened fire hazards and the fact the plant can be used in remote or residential areas where space and equipment are limited. Likewise, the crude-oil plant runs unattended, under the supervision of production department personnel.

Union earlier this year was granted a patent on the cold process and has completed three such plants since January 1950. First was in Sansinena field, in a residential area near Whittier. The other two were in fields near Santa Paula.

The process . . . Main components of the plants are a crude-oil conditioner, absorber, fractionator, atmospheric vent tank, oil-circulating pump, and three small compressors for handling vapors from the vent tank, fractionator, and conditioner. The usual boilers, heaters, heat exchangers, and cooling towers of the conventional plant are not used.

In the conditioner a vacuum of about 12 in. (Hg) effectively strips the raw crude of its butanes and pentanes. The crude then is used to absorb these components, and some propane, from the field gas. In a gas containing about 1½ gal. of isobutane and heavier per M.c.f., about 0.3 gal. is still retained in the plant tail gas. Higher intake concentrations will increase this loss, Gordon declared.

Efficiency . . . In the Sansinena plant, where about 5,000 M.c.f. of 300 psi. gas is being processed daily, approximately 7,700 gal. of products are being recovered through the circulation of about 4,000 bbl. of crude.

The volumes recovered, and the corresponding plant and absorber efficiencies realized under these conditions, were given as: Propane, 1,908 gal., 32.7 and 52.7 per cent, respectively; isobutane, 1,425 gal., 74.5 and 81.5 per cent; normal butane, 1,518 gal., 83.5 and 87.2 per cent; and isopentanes and heavier, 2,852 gal., at a plant efficiency of 73.5 per cent and an absorber efficiency of 76.2 per cent.

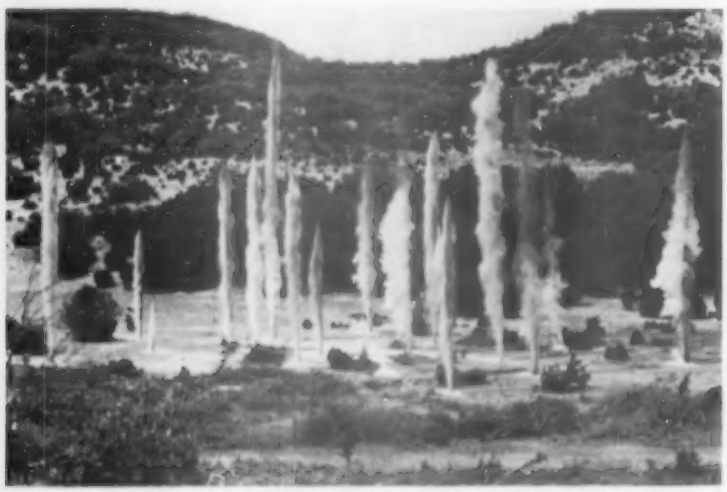
These limitations and operating problems were listed by Gordon for crude-oil absorption plants:

. . . Unbalanced oil-gas ratios result from the more rapid decline of gas than the oil.

. . . Recovery efficiency is low compared with the conventional plant.

. . . Foaming prevents use of the process with some crudes.

. . . It is limited to smaller gas volumes. Where volumes of 5,000 M.c.f. or greater are available, the losses incurred may make it desirable to employ some other method.



"Old Faithfuls" By the Dozen

Resembling miniature geysers, these clouds of smoke and dust are from 250-lb. high-explosive shots set off by a Shell Oil Co. geophysical party west of San Antonio. The charges were placed in 25 shot holes drilled in a pattern to form three concentric circles. The "pattern shot" is used in areas where the usual single charge does not give satisfactory results.

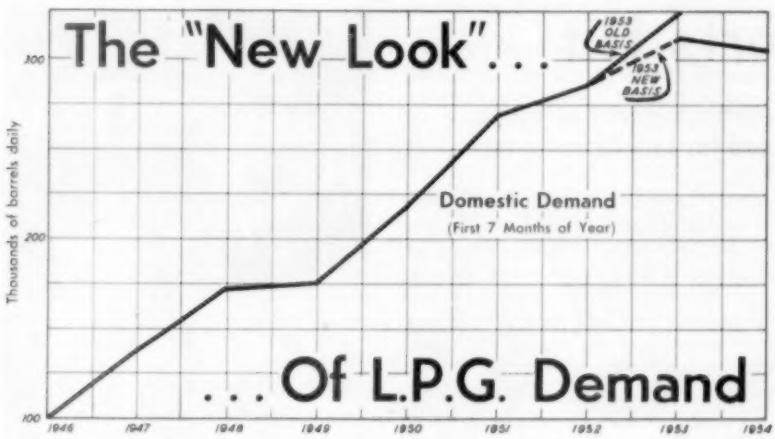
Rig Moved Off Record Hole

BAKERSFIELD.—Ohio Oil Co. last week was moving the big power rig used to establish the world's depth record of 21,482 ft. in Paloma field onto a new medium-deep test in the Cymric area.

Having spudded on October 23, 1951, the company-owned rig thus had spent 3 years on the same location.

Listing the deep test, 72-4 K.C.L.-A, as temporarily suspended, Ohio plans to move in a contract rig in 2 or 3 weeks to continue testing. Possible pays in the 16,000-ft. range proved of no value so that hole has been plugged back to 13,738 ft. As Ohio's lease is for deep rights below the regular Paloma pay it is believed likely that the $2,000,000-plus venture will end as a dry hole.

At its new location 7 miles northwest of McKittrick, the rig was setting up to drill 1 San Francisco Bank as a ¾-mile outpost to a two-well Eocene pool. Anticipated depth for the test, the fourth drilled by the rig since Ohio purchased it in 1947, is about 12,000 ft.



John C. Casper

MORE L.P.G. is going to underground storage and less to consumers' tanks than last year, but the drop in sales has not been as drastic as Bureau of Mines demand figures indicated.

The bureau's monthly petroleum statement for July shows total domestic demand for the first 7 months of the year at 64,981,000 bbl. compared with 69,157,000 bbl. for the same months of 1953. These totals would mean a decrease of 6.0 per cent.

Part of this apparent drop was caused by a change in the reporting system started by the bureau at the first of this year. The revised figures show some drop after the first quarter.

The old method . . . In past years, the bureau asked natural-gasoline and cycling plant operators to report end use of products sold. Operators gave a breakdown of total shipments of L.P.G., showing the volume sent to refineries as well as shipments for fuel and chemical uses.

From these reports, the bureau deducted shipments to refineries from total shipments and credited the remainder to fuel and chemical uses.

The bureau also received reports from refiners showing the L.P.G. received from natural-gasoline and cycling plants each month. Checks made on these reports showed that refiners consistently reported larger receipts of L.P.G. than the plants reported shipping to the refineries.

The new method . . . Since it was thought that the figure on actual receipts at refineries was more accurate than the end-use figure reported by plant operators, the bureau decided to get its total for fuel and chemical shipments by subtracting refinery receipts from total plant shipments.

The new method resulted in an increase in the total credited to use at refineries and a decrease in shipments for fuel and chemical. If the new method had been used last year, the figure on movement of L.P.G. for fuel and chemical uses would have been 4,662,000 bbl. less than the total originally reported. Shipments to refineries would have been raised by a like amount.

Since there was no revision of L.P.G. stock figures, the reduction of 4,662,000 bbl. in the supply of L.P.G. would mean a corresponding cut in the indicated demand for these products.

The accompanying table shows the 1953 domestic demand on the basis now being used by the bureau.

Note that the daily average demand of 345,700 bbl. daily in the first quarter of this year was up 5.8 per cent from the revised average for the same quarter of 1953.

The second quarter average this year, amounting to 277,600 bbl. daily, was 22,700 bbl. daily or 7.6 per cent below the corrected total for the second quarter of 1953. An even greater loss was reported for July.

The relatively large increase in stocks of L.P.G. in the second quarter on this year compared with the same period of 1953 suggests the possibility that some of the movement to underground storage in the second quarter of 1953 may have been credited to direct sales to jobbers.

Additional weight is given this theory by the high demand indicated for that quarter in 1953 compared with the average for the year. The daily average domestic demand for the quarter, even on the revised basis, was 300,300 bbl. daily, or 93.9 per cent of the daily average for the year. In the postwar period, the second quarter daily average has ranged from a low of 84.8 per cent of the annual average in 1947 to 91.7 per cent in 1951.

Latest data . . . L.P.G. stocks at plants and terminals totaled 2,144,000 bbl. at the start of 1953 and had increased to 3,495,000 bbl. by the end of July, a gain of 1,351,000 bbl. Stocks climbed from 3,688,000 bbl. at the first of 1954 to 8,032,600 bbl. at the end of July for a net increase of 4,344,000 bbl.

How It's Figured Now . . .

(Thousands of barrels)

	1953				1954
	As reported	Revision	New basis	Daily avg.	daily avg.
January	11,509	— 584	10,925	352.4	373.7
February	9,895	— 610	9,285	331.6	341.9
March	9,907	— 699	9,208	297.0	321.2
First quarter	31,311	—1,893	29,418	326.9	345.7
April	10,053	— 613	9,440	314.7	299.2
May	9,153	— 81	9,072	292.6	263.1
June	9,005	— 194	8,811	293.7	271.1
Second quarter	28,211	— 888	27,323	300.3	277.6
July	9,635	— 213	9,422	303.9	277.5
August	9,760	— 71	9,689	312.5	
September	9,580	— 231	9,349	311.6	
Third quarter	28,975	— 515	28,460	309.3	
October	9,474	— 216	9,258	298.6	
November	10,682	— 489	10,193	339.8	
December	12,772	— 661	12,111	390.7	
Fourth quarter	32,928	—1,366	31,562	343.1	
Year	121,425	—4,662	116,763	319.9	

Controls, Imports Hit

Oil will be next after gas controls become effective, association told; imports blamed for low Texas output

Paul Swain

SAN ANTONIO, Tex.—The twin specters of federal control and further cutbacks in domestic production due to imports hovered over the thirty-fifth annual meeting of the Texas Mid-Continent Oil and Gas Association here last week.

Federal control of oil as the next step after gas controls drew the most official attention, but the mere mention of curbing imports drew certain applause from members of Texas' oldest and largest association of oil men.

Every speaker except one made some reference to the threat involved in Federal Power Commission authority over natural-gas production. The single exception was Admiral Arthur Radford, chairman of the Joint Chiefs of Staff, the only nonindustry speaker on the two-day program.

Federal regulation . . . The petroleum industry has not sold its story to the natural-gas distributor and consumer—both far from producing fields and production problems—George T. Naff, president of Texas Eastern Transmission Corp., warned the group.

Naff said as a gas pipeliner he'd like to be allowed "like the elephant, to thrust his trunk under the tent and attempt to demonstrate that he, too, is part of the circus."

The pipeline president warned that "a very large segment of the consumer public" regards the frozen field price of gas as attractive. He reminded that as the field price of gas has spiraled, distributors have sought and received rate increases. Both consumers and distributors have lost faith in "the general proposition that the law of supply and demand will protect him in his indirect relationship with the producer."

The distributor and consumer alike think of natural gas in terms of "only bills for increased amounts" and not in terms of a long-range and stable supply of gas made possible by a good field price for gas and the resulting exploration and development of gas fields.

On the same subject but from a different point of view, J. C. Donnell II, president of Ohio Oil Co. told the association that federal regulation of gas production "as if it were a public-utility type operation" will result in reduced supplies of natural gas "within a relatively short time."

Donnell urged action to amend the Natural Gas Act to restore the "original intent of Congress."

He warned that federal controls of natural-gas liquids must follow controls of gas and then will come oil and coal.

Imports . . . In his introduction of Adm. Radford, Gen. E. O. Thompson, chairman of the Texas Railroad Commission, referred to a current tongue-in-cheek Texas story about the easy life oil producers lead—a 2-week vacation in every month.

GEORGE T. NAFF . . . "A very large segment of the consumer public regards the frozen field price of gas as attractive."

Thompson blamed excessive imports of foreign oil for the fact that Texas producers are restricted to only 15 days production during the 31-day month of October. He said the financial reports of importing companies reflect that theirs is a profitable operation and reminded his listeners "the profit motive is very strong."

The commission chairman expressed confidence that the President's Cabinet committee report, due December 1, on a fuels policy for the nation will offer some sort of solution for the domestic producer.

Free industry lauded . . . In an atmosphere heavy with opposition to government interference, E. C. Manning, premier of Alberta, struck a responsive chord when he told the group that his philosophy is "the less government interference and regulation the better."

"The physical restrictions surrounding nature's treasures are great enough obstacles to the oil man without any that any government might superimpose on top of nature's," the personable Canadian premier said.

Alberta's theory, he said, "is that a layman elected to office does not automatically become an expert in oil and gas." Manning said his government

MORE THAN A THOUSAND of the 4,000-plus members in the oldest and largest association of Texas oil men attended the thirty-fifth annual meeting of the Texas Mid-Continent Oil and Gas Association at San Antonio last week.

feels it should "sit down with people who have spent their lives in the oil business and be guided and advised by them."

In a resume of Alberta's oil development, Manning outlined his policy toward an oil industry which has converted his province from bankruptcy to solvency since 1938. He said doing "everything to encourage development under competitive and private enterprise" has enriched his province by some $230,000,000 since 1948.

Resolutions . . . The association went on record for legislation to remove gas producers from federal authority and "reaffirming its support of the theory that oil imports should "supplement and not supplant" domestic production.

Harry W. Bass, Dallas independent, was reelected president without opposition, along with the entire present slate of officers. They include Charles E. Simons, Dallas, executive vice president; Andrew M. Howsley, Albany, Tex., vice president and general counsel; and Eugene McElvaney, Dallas, treasurer.

Oil Is Challenged

Competition is mounting, Sinclair president warns

SAN ANTONIO.—The oil industry must develop an ability to roll with the punches of an ever-changing way of technological life in an era of changing energy markets in a changing world, P. C. Spencer, president of Sinclair Oil Corp., told the Texas Mid-Continent Oil and Gas Association here.

Spencer pointed out that the oil industry itself is changing rapidly, but not as rapidly as the changes "in so many fields of activity, which vitally affect the lives of men."

He said few, if any industries have escaped the impact of these changes —the oil industry least of all. He cited the changes in demand for crude oil and declared that improved processing and recovery methods now allow the refiner to produce more high-priced light products than ever before.

"Simply stated," Spencer declared, "it takes less crude today, by perhaps 10 per cent, to produce the same quantity of light products as was produced 5 years ago."

He labeled the automobile as the technological achievement which really gave birth to the oil industry as it is known today. At the same time, he said, other and later inventions such as television exert a counter influence. Spencer credits the advent of television with keeping the family automobile in the garage—thereby "contributing to the current lower rate of increase in gasoline consumption."

Energy requirements . . . Sinclair's president told the Texas oil men that oil must remember it is only a part of a "mammoth energy business." He said a growing number of customers measure their purchases, not by product, but B.t.u.'s per dollar.

"More and more buyers are equipping themselves to use any one of several sources of energy, as price and efficiency dictate," he said.

He called for an "integration" within the industry to solve industry problems and declared that every segment of the industry must learn to know and understand the individual problems of all others.

Spencer hailed the President's appointment of a committee to study energy supplies and resources as "particularly timely."

He predicted that the problems which have confronted the oil industry in the past will become intensified as energy needs and sources change. Spencer warned that meeting the problems of the future will require "foresight, intelligence, true cooperation and a lot of just plain guts in increasing amounts."

Gas Committee Formed

SAN ANTONIO, Tex.—Fearful of encroaching federal controls, the oil industry last week quit merely talking about the threat and began drafting legislation to specifically exempt natural-gas production and gathering from control by the Federal Power Commission.

The formation of a nationwide "general gas committee" made up of representatives of both independents and majors was disclosed here on the eve of the annual meeting of the Texas Mid-Continent Oil and Gas Association. The committee, headed by Maston Nixon, Corpus Christi, president of Southern Minerals Corp., will establish the policy for legislation to be drafted by a legal group and presented to the next session of Congress.

The committee numbers more than 400 independent producers, officials of major oil companies, representatives of transmission lines, utility representatives and associations of oil and gas producers.

Members of the committee said last week that the form of the legislation to be sought has not yet been decided upon, but indicated they will probably direct their efforts toward amending the Natural Gas Act to clarify it.

Arrow Drilling Sold

New owner also undergoes changes among directors

TULSA.—All outstanding stock of Arrow Drilling Co., Tulsa, has been acquired by British Empire Oil Co., Ltd., Calgary, which also underwent some changes last week.

Among the changes made in British Empire were changing of the firm's name to Canadian British Empire Oil Co., Ltd., and naming of a new board of directors.

Henry R. Benjamin, New York, majority stockholder in both firms, was named chairman of the board of Canadian British. Other board members are: Donald Royce, Los Angeles, president of William R. Staats & Co.; John P. Ohl, New York, partner in Cahill, Gordon, Reindel & Ohl; Frank B. Bateman, New York, vice president of Blair & Co.; Louis R. Myers, Little Rock, president of Batesville White Lime Co.; Cecil Chesher, Calgary geologist; John S. Davidson, Vancouver insurance executive; and Robin F. Scully, Beatrice, Neb., independent oil operator.

The acquisition of Arrow follows a recapitalization by Canadian British. Arrow operates 24 rigs, 18 in the United States and 6 in Canada. Canadian British holds about 400,000 acres in Canada and the Rocky Mountain area.

Robert B. Curran is president of Canadian British Empire. D. L. Edmiston, a former Arrow vice president, has been elevated to president of Arrow *(for a biographical sketch of Curran see page 341).*

Union Merger Delayed?

WASHINGTON.—Merger of the Oil Workers International Union and the United Gas, Coke and Chemical Workers Union may not be consummated until January.

The chemical workers have tentatively dropped plans to hold a special convention next month following the O.W.I.U. convention at which the oil workers will vote on the amalgamation.

Heads of the two organizations, O. A. Knight and Elwood Swisher, were in Washington last week for a C.I.O. meeting and conferred on merger plans. Final decision on the special meeting of the chemical union is to be made this week, but Swisher explained that the cost of the recent convention was a strain on some locals which would not be able to finance delegates to the proposed November meeting.

Nation Counts Blessings of Oil

THE nation will stop and listen this week while the petroleum industry toots its horn.

Hundreds of programs from coast to coast have been arranged in observance of the seventh annual Oil Progress Week, keyed to the theme, "Oil Serves You."

Observances will range from addresses by presidents of some of the world's biggest oil companies to eye-catching parades featuring lovely lasses clothed entirely in oil-made products; from classroom demonstrations to the showing of the new motion picture, "The Story of Colonel Drake;" from "magic barrel" exhibits to distribution of pamphlets at service stations.

It all adds up to probably the greatest concentration on public relations ever made by the petroleum industry.

Early start . . . Observance of Oil Progress Week jumped the gun at Titusville, Pa., site of the world's first commercial oil well.

There, Mrs. E. Ross Carver, a granddaughter of the man who drilled that historic well, was honored guest at a luncheon observing the 95th birthday of the oil industry. The celebration also featured the premiere showing of the color film depicting the fabulous story of Col. Edwin Laurentine Drake, founder of a fabulous industry.

Elsewhere in the country, "The Story of Colonel Drake" will be widely shown during Oil Progress Week. Fifty showings of the film are planned in a single county in New York during the week-long observance, and every television station in Chicago is scheduled to show the film.

Top speakers . . . Some of the industry's top spokesmen will tell the story of oil at meetings scattered across the country. They include T. S. Petersen, president of Standard Oil Co. of California; David T. Staples, president of Tide Water Associated Oil Co.; R. L. Minckler, president of General Petroleum Corp.; Raleigh Warner, chairman of the board of Pure Oil Co.; B. Brewster Jennings, president of Socony-Vacuum Oil Co.; H. S. M. Burns, president of Shell Oil Co.; Howard G. Vesper, president of California Research Corp., and many others.

The annual observance is sponsored by the Oil Industry Information Committee of the American Petroleum Institute.

Refinery Merger Seen

NEW YORK.—Mid-West Refineries, Inc., has taken an option to acquire controlling interest in Roosevelt Oil & Refining Corp.

Financial plans have not been completed, but merger of the two Michigan companies appeared probable last week.

Both firms have modernized refineries and serve similar markets. Roosevelt specializes in naphthas and chemicals.

Mid-West operates a 10,000-bbl. refinery at Alma, Mich. Roosevelt has a 7,500-bbl. refinery at Mount Pleasant, Mich.

Sun, Atlantic Get Awards

PHILADELPHIA. — Sun Oil Co. and Atlantic Refining Co. last week were awarded Drexel Institute of Technology Founder's Medals for their "contribution to the industrial vitality of the Eastern Seaboard and to the strength of the national economy."

Presentation was made at a dinner observing the 100th anniversary of the establishment of the refining industry.

In presenting the awards, Dr. James Creese, president of Drexel Institute, pointed out that Sun and Atlantic helped the Philadelphia area become the second-ranking refining center of the world. Los Angeles previously ranked second to the Gulf Coast area.

Dr. Creese announced that Drexel alumni had underwritten a scholarship in memory of the late Charles E. Maschal, who was graduated from the institute in 1931 and served as manager of Sun's refinery at Marcus Hook, Pa., prior to his death earlier this year.

Sohio Cuts Crude Price

CLEVELAND. — Sohio Petroleum Co. announced a reduction of 12 cents a barrel in the posted price for crude from the tri-state area of Illinois, Indiana, and western Kentucky. The price was effective October 1.

The new posting of $2.90 a barrel meets the reduction put into effect by Ashland Oil & Refining Co. near the middle of July and brings Illinois basin crude down to the level of 40-gravity crude in the Mid-Continent and North Texas.

At the same time, Sohio lifted pipeline proration which it had inaugurated at the time Ashland announced the price cut for the area.

Sohio also cut 6 cents a barrel off the posting for crude from Coldwater field in Michigan. Other purchasers of Michigan crude had announced price reductions averaging about 12 cents a barrel, effective June 1.

Rock Island Refining Corp. and Louden Pipe Line Co. also have announced a reduction of 12 cents a barrel in the posted price for crude from the Illinois basin, effective October 1.

Shale Halt Asked

NPC to recommend that Interior end experiment

WASHINGTON.—A National Petroleum Council subcommittee is expected to recommend that the Department of Interior end its research with oil shale at Rifle, Colo., and turn over its experimental facilities to private industry.

Secretary of Interior Douglas McKay had asked for the report by NPC after another group made substantially the same recommendation to the department in the spring.

A proposal was brought up in Congress during its last session to eliminate funds for the Bureau of Mines at Rifle. The motion was successfully opposed, and observers feel another attempt would bring extensive debating on whether the plant should be sold or leased to private industry.

The subcommittee's recommendation will be presented to the full committee October 18 and, if the committee approves, it will be reported to the NPC at its fall meeting October 19.

Union Plans Shale Plant

DENVER.—Union Oil Co. of California has decided to build an oil shale plant at Rifle, Colo., despite the reluctance of other major oil companies to go along.

The Government recently ended a 5-year experimental program at Rifle during which it proved that thermal cracking of crude shale oil, followed by sulfuric acid treatment of naphtha, is technically feasible for producing gasoline *(The Oil and Gas Journal, September 20, page 136)*.

A. C. Rubel, vice president of Union, said no attempt to build a plant will be made for 2 or 3 years. Rubel added the plant will be large enough to produce products on a competitive basis with present refineries.

Memo to the small refiner:

You CAN make petrochemicals

G. L. Farrar

TULSA.—How does the small refiner get into the petrochemical business? Through the back door, according to Dan M. Krausse, assistant to the president of Cosden Petroleum Corp., Big Spring, Tex.

The small company cannot begin manufacturing petrochemicals on a large scale since necessary research facilities and working capital are not available, he said. Rather, a small refiner must develop a product at a time. He must begin on a small scale and grow as markets are developed.

Krausse gave this outline while speaking at the annual state-wide meeting here of the American Institute of Chemical Engineers.

Cosden, he said, started out in this manner. It installed a Unisol unit at the Big Spring refinery in 1946 to remove mercaptans from thermally cracked gasoline. At this time the natural-gas industry was beginning to expand and more mercaptans for odorizing were needed. Cosden installed facilities to purify and fractionate the mercaptans.

Purified products were made available to an established chemical company, and soon a market was developed for a full line from methyl though butyl mercaptans.

The market has now been developed to such an extent that raw mercaptans are now being processed from natural-gasoline plants as far away as Wood River, Ill., he added.

Cresylic acid . . . Immediately after World War II, Cosden began an examination of the spent-caustic solutions which had been used to treat cracked naphthas. It was found that these solutions could be neutralized with hydrogen sulfide, and that a solution of acid oils could be recovered, he said. Further work proved that these oils could be recovered and separated into several grades of cresylic acids. These materials are sold to the manufacturers of surface coatings, resins and plasticizers, industrial detergents, and ore-flotation agents.

To minimize yield of residual fuel oil, Cosden built a fluid catalytic cracking unit in 1949. Originally the catalytic cycle oils were sold in the domestic heating-oil market, but it was soon discovered that this aromatic stock is prime feed stock for carbon-black production. Consequently, Cosden contracted in 1951 to furnish oil feed to a furnace-black plant which was constructed adjacent to the refinery, Krausse said.

The presence of appreciable quantities of isobutylene in certain refinery gases led Cosden to initiate work on the possible manufacture of high-viscosity polymers from this material. A successful commercial process was developed and is now operating, utilizing a nonselective feed stock of mixed olefins. A high quality polymer of good color, odor, and stability is produced.

These high-viscosity polymers are used in pressure-sensitive adhesives, surface coatings, resin modifiers, asphaltic specialties, and lubricating-oil additives. As in other ventures, Cosden interested an established firm in the field. Process development and manufacturing are done by Cosden, and product development and marketing by the partner, he said.

Aromatics . . . When demand for aromatic hydrocarbons from petroleum mushroomed some 3 or 4 years ago, Cosden found that straight-run gasoline from its Big Spring refinery contained a high percentage of naphthenes.

Consequently, a Platforming-Udex combination was installed, and manufacture of aromatics was begun in September, 1952.

The Platformer is operated in blocked-out operation, with aromatics being produced a portion of the time—and motor-gasoline stocks the remainder. This gives flexibility, both to the aromatics and gasoline operations, Krausse said.

Xylene isomers . . . Operation of the Platforming-Udex unit to produce required amounts of benzene and toluene also made nearly seven million gallons per year of chemically pure xylene available. The heavy demand for para-xylene for use in making Dacron made the separation of this isomer particularly attractive.

Phillips Petroleum Co. developed a fractional crystallization process for the recovery of para-xylene from the other isomers, and Phillips and Cosden entered into a joint venture, Krausse said. Phillips designed and built the recovery unit adjacent to the refinery.

Many opportunities . . . The refiner, Krausse said, must provide the best utilization of crude oil and natural gas to meet the needs of the consumer.

There are many opportunities to extend use of certain raw materials into the field of petrochemicals. This can be done a step at a time, without excessive expenditures, if opportunities are recognized and taken advantage of, he said.

SPEAKERS at the Oklahoma A.I.Ch.E. meeting were, seated, left to right: Dr. B. F. Dodge, chairman of the department of chemical engineering, Yale University, and next national president of the institute; Dr. M. B. Goren, Kerr-McGee Oil Industries, Inc., Oklahoma City; and Dr. C. A. Stokes, Godfrey L. Cabot, Inc., Boston. Standing are: John F. Gilmore, Blaw-Knox Co., Tulsa; Paul L. Weller, Spencer Chemical Co., Kansas City; D. M. Krausse, Cosden Petroleum Corp., Big Spring, Tex.; E. D. Anderson, Western Supply Co., Tulsa; and A. J. DeCillis, Continental Oil Co., Ponca City, Okla. Approximately 150 chemical engineers attended the all-day meeting.

I.P.A.A. Talks Set

McCollum and Wormser to speak at convention

TULSA.—Felix E. Wormser, assistant secretary of the interior for mineral resources, and L. F. McCollum, president of Continental Oil Co., will address the Independent Petroleum Association of America at its annual meeting here October 25-26.

Wormser has supervision over the U. S. Bureau of Mines, the U. S. Geological Survey, and the Interior Department's Oil and Gas Division. His topic will be "Oil and Interior."

McCollum, who started his oil career as a geologist in 1925, has been president of Continental since 1947. He previously served as president of Carter Oil Co. and coordinator of the worldwide operations of Standard Oil Co. (N. J.).

I.P.A.A. committee meetings will be held October 22-24.

The convention is expected to attract more than 1,000 delegates.

Reformer Construction Set

ASHLAND, Ky. — Catalytic Construction Co. of Philadelphia will begin work October 15 on a Houdriformer at the No. 2 plant of the Catlettsburg refinery of Ashland Oil & Refining Co.

The new unit, which is slated to go on stream in mid-1955, will have a 6,000-bbl. reforming capacity and 8,500-bbl. pre-treating capacity.

Industry Briefs

DENVER.—Stockholders will vote November 3 on the merger of Derby Oil Co., Wichita, into Colorado Oil & Gas Corp., Denver. The merger has been approved by the boards of directors. Plans call for creation of a wholly owned subsidiary, Derby Refining Co., to operate the refinery, pipelines, and marketing facilities of the merged company. W. G. Tierney, Derby president, would become president of the subsidiary and a vice president and director of the parent company.

AUSTIN.—The Texas Railroad Commission has approved Gulf Oil Corp.'s application to leach out and use a third large underground cavity in Fannett field of Jefferson County, Texas, for storage of products from its nearby Port Arthur refinery. The newest cavity, largest of the three, will have a capacity of about 250,000 bbl. It will be washed out of a salt section underlying Gulf's E. Thomas et al. lease, William H. Smith Survey, at 2,113 ft.

WASHINGTON. — A special National Petroleum Council committee has been appointed to prepare a suitable memorial resolution to the late Max W. Ball. The resolution will be presented at the October 19 meeting of the council. B. L. Majewski, president of the Great American Oil Co., Chicago, will head the committee. Members are Warwick M. Downing, Denver; J. Howard Marshall of the Signal Oil & Gas Co., Fort Worth, Tex.; Glenn E. Nielson, Husky Oil Co., Cody, Wyo.; and Joseph E. Pogue, Chase National Bank, New York.

BAKERSFIELD.—Plans for drilling a wildcat 11 miles northwest of Anchorage, Alaska, have been revealed by J. L. Scarbrough, Bakersfield. Scarbrough said he and Chester Ashford, McFarland, Calif., purchased controlling interest in Alaska Gulf Oil & Gas Development Co. and may have a rig set up on a 51,000-acre lease in Alaska before the winter freeze.

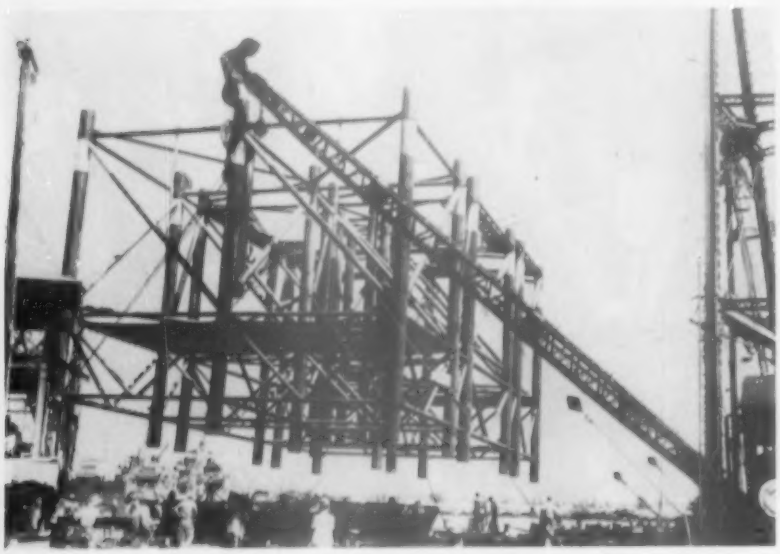
CALGARY.—Royalite Oil Co., Ltd., plans immediate construction of a six-story building here to house its home offices. R. D. Mercer, recently promoted to manager of buildings, real estate, and construction for the company, said the structure is expected to be completed in about 18 months.

WASHINGTON.—Oil and gas leases on 17 parcels of land totaling 6,908 acres in the known geologic structure of the Cedar Creek field in Bowman County, approximately 30 miles west of Bowman, N. D., will be sold by the Bureau of Land Management October 27. The leases range from 40 to 631 acres in size.

MIDLAND, Tex.—Pan American Pipe Line Co. will extend its crude-gathering system northeast from its Sterling station in northeastern Sterling County, Texas, to tap Jameson and Fuller-Coke fields in Coke County. The line, comprising 10 miles of 6-in. and 4 miles of 4-in., will tie in at Sterling with the company's line running south from Scurry County to Eldorado, Tex., where it connects with the Rancho trunk line to the Gulf Coast.

WICHITA. — Kansas Corporation Commission has set the crude oil allowable for October at 352,000 bbl. daily not including condensate.

HOUSTON.—W. J. Mechura, Houston oil man acting as an agent for Brazos Oil & Gas Co., has purchased approximately 650 acres of oil and gas properties in Green Lake field, Calhoun County, Texas. The properties were brought from Armstrong & Horn Drilling Co., W. C. McBride, Inc., C. D. Mahaffey, and W. B. Trammell. The price was not revealed. Included in the deal are three oil wells and one dually completed gas well.



New Jacket Assembly for Calco Platform

This jacket assembly for a template-type offshort drilling platform is loaded onto a barge at the Higgins, Inc., shipyard in New Orleans, to be transported to an offshort location at the mouth of the Mississippi River. The California Co. will drill in 40 ft. of water near Main Pass.

Dakota Price Posted

Stanolind Purchasing's $2.50 top for North Dakota crude draws protests from producers; $2.90 top was expected

BISMARCK.—A top price of $2.50 per barrel for North Dakota crude oil has been posted by Stanolind Oil Purchasing Co., effective October 15.

The announcement was made immediately after dedication of the 30,000-bbl. refinery at Mandan operated by Stanolind's parent, Standard Oil Co. (Ind.). It also followed the startup of crude movements through the new pipeline of Service Pipe Line Co., another subsidiary of Indiana Standard.

Previously Stanolind had been paying $2 per barrel at the well head and shipping the crude by tank car to more distant refineries, chiefly Standard's plant at Whiting, Ind.

Producers were disappointed in the posting, as they had expected that operation of the refinery and pipeline would bring them the general Mid-Continent gravity scale which has a top of $2.90 per barrel.

The posting is $2.50 per barrel for crude of 40° gravity and above with a differential of 2 cents for each drop of 1° of gravity. This applies in fields connected to the pipeline: Beaver Lodge, Tioga, East Tioga, Capa, Charlson, Hofflund, and White Earth. Other fields will get this scale less the cost of trucking the oil to the pipeline, including Croff, Keene, McGregor, Fryburg Madison, and Sanish.

Why it's $2.50 . . . Officials of the Indiana Standard group of companies explained that they could not post the Mid-Continent scale because of competition. They cited these reasons:

. . . Eastern Montana production is now about 16,000 bbl. per day and is selling at $1.42 to $2.00 per barrel at the well head, or an average of about $1.70 per barrel. This crude, they said, could be delivered at Mandan on a par with $2.50 crude from Beaver Lodge and Tioga. They also cited Wyoming crudes selling below the general gravity scale.

. . . A new refinery under construction at St. Paul, which will market products in the same general territory, will use crude from the Fosterton area of Saskatchewan and Standard officials said they understood this crude would be priced at about $1.85 per barrel at the well head.

. . . The gasoline market in the Dakota-Minnesota area is soft, the tank-car price of gasoline has recently been cut, there are local price wars among filling stations, and marketing competition is intense, all of which, Standard officials said, prevents paying a higher price for crude for the Mandan refinery.

Producer objections . . . Irate producers call these arguments "nonsense." In rebuttal they say:

. . . Only 250 bbl. per day of eastern Montana crude is selling at $1.42, so the weighted-average price is well above $1.70. The rest of this crude is selling for $2 (the price originally set by Stanolind Purchasing for North Dakota), but since these fields have no pipeline outlet the purchasers must bear high rail charges to get the crude to refineries.

. . . There is only half enough crude in eastern Montana to supply the Mandan refinery, and if Standard attempted to purchase it all the price would immediately rise.

. . . The amount of crude in Wyoming and elsewhere selling below the general gravity scale is very small and does not affect the competitive situation in North Dakota.

. . . The new refinery at St. Paul will not be on stream and marketing products for about a year, so Standard is premature in pricing crude on the basis of anticipated potential future competition. The Fosterton crude is of low gravity and it is not known what its field price will be a year hence when the pipeline to St. Paul is completed.

. . . The Mandan refinery is highly efficient and is designed specifically for economical processing of the high-gravity, low-sulfur North Dakota crude brought to it by a short pipeline haul. In the past Standard has been serving North Dakota with products shipped from Whiting which were made from $2.90 crude moving long distances from Mid-Continent fields.

. . . Marketing competition and weak products prices are no worse in the North Central states than anywhere else in the country, and if that is justification for a low price for North Dakota crude it is justification for cutting the price of crude everywhere.

. . . Standard's marketing competitors in that area use $2.90 crude and have longer hauls for both their crude and their products, so it appears that Standard is preparing to take the lead in a price war.

Amerada's Reaction to the New Price

". . . We had confidently expected that with the completion of the Mandan refinery . . . the operators and royalty owners in the Beaver Lodge and Tioga fields would receive for their oil the same price of $2.90 per barrel which Standard Oil Co. and other major purchasers are paying for oil of similar quality in many Mid-Continent and Rocky Mountain fields in which they are buyers. In no other field of the country, with pipeline outlet, is oil of this quality posted at a price as low as $2.50 per barrel.

"The oil produced in the Beaver Lodge and Tioga fields admittedly compares most favorably . . . with the crude oils for which the price of $2.90 per barrel is being paid in such other fields; it will be transported from the field to the refinery through a shorter pipeline and at lower costs than similar transportation costs elsewhere; the oil will be refined in the newest and most up-to-date refinery in the country; and the refined products will be marketed by Standard Oil Co. in the same areas and at the same prices as the products derived from crude purchased in other fields at $2.90 per barrel, with higher transportation costs than those applying to the oil produced in the Beaver Lodge and Tioga fields.

"In view of the above facts we fail to see the reason for the discrimination of 40 cents per barrel against Beaver Lodge and Tioga crude. Unfortunately, however, as Standard Oil Co. owns the only pipeline outlet from the fields, we cannot secure competitive offers for the oil, and for the present we must accept the unfair and discriminatory price posted by Standard Oil Co. We feel it incumbent upon us, however, to make this statement for the information of our royalty owners, largest among whom is the State of North Dakota, and of the general public."

A. Jacobsen, President,
Amerada Petroleum Corp.

Rockies Set Record

Region gets 3,009 wells in first three quarters

DENVER.—Drilling in the Rocky Mountain region hit a record cumulative total of 3,009 wells for the first three quarters of the year.

During the third quarter, the area's operators finished 1,107 wells compared with 934 for the corresponding three-month period of 1953.

Wyoming, Colorado, and western Nebraska led the area in well completions and new discoveries. Colorado has replaced Wyoming in first place. Through October 1, Colorado had 952 completed wells. Wyoming is second with 939, and Nebraska third with 313.

Exploration . . . Wildcatting netted 121 new pools and new pays in the first three quarters of the year. Colorado has a slight margin over Wyoming in the discovery race with 36. Wyoming reports 35 new strikes this year, Nebraska 21, and Montana 6.

A wildcat footage record of almost 5,500,000 ft. promises that this year will set new records in the area. Total Rocky Mountain footage has reached 16,000,000 ft. plus.

July was the record month in the Rocky Mountain states. August fell slightly, but operations are beginning to come back this fall. The industry plans to finish the year with more than 4,400 wells completed. The grand total last year was 3,417 wells.

Montana Field Extended

GLENDIVE, Mont.—One of eastern Montana's best Williston basin oil fields has been extended 1 mile south with the success of two ½-mile stepout wells.

Shell Oil Co.'s 23-15-A Unit and 21-22-A Unit in Pine field, Wibaux County, both reported good flow rates. The first well, located ½-mile south of nearest Pine production, flowed 635 bbl. of oil per day on ½-in. choke from Ordovician Red River perforations. The latter well flowed at the rate of 805 bbl. per day from the same formation. It is located ½ mile south of the first well.

Pine field has 11 completed wells.

Slant-Hole Well Completed

WILLISTON, N. D.—North Dakota's first directional well has been completed by Amerada Petroleum Corp. in a portion of Hofflund field that eventually will be flooded by Garrison reservoir.

The well, 2 Joseph Viall, flowed 242 bbl. daily of 42°-gravity crude from the Madison at 8,650 ft. The well was drilled vertically to 2,600 ft., then whipstocked to the total depth of 8,654 ft. The bottom of the hole was 1,892 ft. from vertical.

The rig is on a bluff overlooking a valley that will be flooded by the Missouri River backing up from the Garrison dam. *(The Oil and Gas Journal, June 14, page 102).*

GULF COAST

Offshore Groups Formed

HOUSTON.—Four companies have teamed up to conduct a joint exploration program off Texas, and three of the four have formed a similar combine to operate off Louisiana.

Pure Oil Co., disclosed last week it has signed an agreement with Sun Oil Co., Seaboard Oil Co. of Delaware, and Ohio Oil Co. to work off Texas.

Pure, Ohio, and Sun signed a similar agreement covering Louisiana offshore activity.

Seismic operations already have been started in some areas of the Texas tidelands. The agreements provide that acreage acquired will be "adequately tested."

Pure recently staked location for a wildcat off Texas, about 12 miles off Galveston County, in partnership with Melben Oil Co. and Ohio. A platform has been erected and the test will be spudded soon.

The new operating groups are expected to bid on acreage offered at the federal offshore-lease sales on October 13, for Louisiana, and November 9, for Texas.

Wilcox To Be Discussed

HOUSTON.—A symposium on the Wilcox formation will be a highlight of the fourth annual meeting of the Gulf Coast Association of Geological Societies, to be held in Houston November 3-5.

Gas System To Be Opened

HOUSTON.—Gulf Interstate Gas Co. will dedicate its new $130,000,000 pipeline system at a compressor-station site near Rayne, La., October 17, and the 1,150-mile line will officially go into service around November 1.

The line will deliver 375,000,000 cu. ft. of natural gas daily from South Louisiana to West Virginia for Columbia Gas System.

CANADA

Sand-Test Begun

Company attempts to tap rich Athabaska deposit

EDMONTON.—An experimental portable oil extraction unit has been put into operation to tap the rich Athabaska oil sands of northeastern Alberta.

S. M. Paulson, of Calgary, president of Can-Amera Sands Development, Ltd., said the unit has proved "most satisfactory."

The company, along with Mill Creek Oil Co., Ltd., is carrying out tests to perfect a commercially practical process for separating oil from the sands. Paulson said the recent tests seem to have proved that the work the companies have been carrying out for 2 years has resulted in a satisfactory method to extract the oils, which, according to company officials, favorably compared with Gulf Coast or Venezuelan oil.

The unit, which was shipped from Poughkeepsie, N. Y., to the Alberta government plant at Bitumont, 270 miles north of Edmonton, employs a secret technique. The unit was constructed by DeLaval Separator Co., of Poughkeepsie.

Can-Amera acquired hole-working rights and an option to purchase the Alberta government experimental plant at Bitumont.

Oil has in the past been produced from the sands and some has been sold in the north. Certain general methods of extraction have been found, but oil company officials say they are not satisfied these are the best which can be worked out.

Oil authorities claim oil reserves in the sands would last Canada 1,800 years.

Gasoline Plant on Stream

EDMONTON.—Progas, Ltd., Calgary, has placed its second natural-gas processing plant on stream in the Acheson-Stony Plain oil field, about 5 miles west of Edmonton.

Initial operations indicated satisfactory recoveries of propane, butane, and natural gasoline yielding approximately 16,000 gal. daily for the combined products. Plant capacity permits handling 4,500,000 cu. ft. of raw gas per day obtained from field separators and vapors recovered from oil storage tanks.

Residue gas will be sold when transmission facilities are completed. A pipeline is being laid by Northwestern Utilities, Ltd., to Edmonton.

New Units Planned

Shell to add fluid crackers at Cardon, Curacao plants

TWO units which will add substantially to catalytic cracking capacity in Latin America are planned by the Royal Dutch-Shell Group in Venezuela and the Netherlands West Indies.

Fluid crackers, each of 35,000 bbl. daily capacity, will be built at refineries at Cardon in Venezuela and at Curacao in the Netherlands West Indies. The first, that at Curacao, probably will be on stream the end of 1957 or early in 1958.

Design for the units has been done by N. V. DeBataafsche Petroleum Mij., a Royal Dutch-Shell operating company, at The Hague. Contracts for engineering and construction have not yet been let. The two units will cost more than £20,000,000, equivalent to $56,000,000.

The Curacao and Cardon refineries are among the largest in the Western Hemisphere. The Curacao plant, which operates on Venezuelan crude, has a nominal capacity of 200,000 bbl. daily but its crude intake, including crude charged to thermal cracking plants, was 297,900 bbl. daily at the end of last year. Present thermal cracking plants have a capacity of 100,000 bbl. daily.

The Cardon refinery, on which work was begun shortly after World War II, has a crude capacity of 145,000 bbl. daily. Capacity of the thermal cracking plants is 25,000 bbl. daily. Crude intake of the refinery at the end of last year was 163,500 bbl. daily, including crude charged to the cracking plants.

Total catalytic cracking capacity in Latin American refineries will amount to about 114,000 bbl. daily by the end of the first quarter of next year. Present units give a catalytic cracking capacity of nearly 6 per cent of the total crude capacity of Latin American refineries of 1,916,000 bbl. daily *(The Oil and Gas Journal, August 16, page 107).*

Borneo Plants Operating

British Mayalan Petroleum Co., Ltd., a Royal Dutch-Shell subsidiary, has placed a gasoline plant and small crude topping unit in operation at Seria field in Brunei, North Borneo.

The topping plant will process about 100 tons, or 700 bbl. daily, to meet the field's requirements for gasoline and diesel oil, plus a rapidly growing private demand for fuel.

The gasoline plant will extract about 1,700 bbl. of hydrocarbon fractions from gas produced at the field. The light distillates will be moved through a new 4-in. line to the Lutong refinery in northern Sarawak for blending.

Sarawak Oilfields, Ltd., another Royal Dutch-Shell subsidiary which operates in Sarawak where the Lutong plant and the now nearly depleted Miri field are situated, is preparing to drill two new exploratory tests at Suai about 45 miles south of Miri.

The rig is being erected at the first of these locations and drilling is to commence in the near future. Three earlier wells drilled in the Suai area included two with negative results in 1952 and one last year which had slight oil shows. A gas blowout caused abandonment of this hole.

Belgian Unit Goes on Stream

THE Belgian company, Albatros S.A. Belge pour le Raffinage de Petrole, has placed a new 3,600-bbl. daily Houdriflow catalytic cracking unit on stream at its Antwerp refinery.

The unit charges gas oil from Persian Gulf crude. It circulates bead catalyst at the rate of 110 tons per hour and has a coke-burning design capacity of 2,000 lb. per hour. Average cracking temperature is 880° F.

Houdry Process Corp., Philadelphia, handled engineering and procurement, assisted by Head Wrightson Processes, Ltd., London. Houdry also furnished two construction supervisors for the erection of the unit. Petrocarbon, Ltd., Manchester, England, acted as consultant to the Albatros company.

The higher-quality motor fuel produced by the unit will be marketed in Belgium to help meet demand resulting from the increasing number of American-made vehicles.

Construction of the Houdriflow unit represents a major part of a modernization and expansion program being carried out at the Albatros refinery. The company, formerly known as Redeventza S.A. Belge pour le Raffinage de Petrole, was formed in 1934 to build and operate the first independent refinery in Belgium. First refining operations were begun the following year.

Postwar expansion . . . The plant was badly damaged during the war and was rebuilt in 1948. The company was reorganized at the same time and its name changed to Albatros. Operations were resumed in January 1949.

The refinery, which is located on the Scheldt River, has a capacity of about 12,000 bbl. daily. Ultimate expansion to 15,000 bbl. daily is planned. The program on which construction was begun last year includes a new crude unit, feed preparation, the Houdriflow unit, gas recovery and stabilization, a 500-bbl. daily plant for the polymerization of light olefins produced in the cracking operations, and new facilities for treating straightrun and catalytic gasolines.

The postwar refining expansion in Belgium has built up crude capacity of the eight refineries in the country to about 105,000 bbl. daily. The two largest refineries are the 25,000-bbl. daily Esso Standard Refinery, S.A., plant, and the 40,000-bbl. plant of Soc. Industrielle Belge des Petroles owned by Anglo-Iranian and Petrofina. A 10,000-bbl. daily catalytic cracking unit and polymerization facilities are being added at the SIBP refinery.

Test Finds Shows

Stained cores recovered in wildcat close to Bordeaux

ESSO STANDARD S. A. FRANCAISE has had shows of oil in cores recovered in its latest wildcat in southwestern France.

The well is near the village of Carcans adjoining Lake Lacanau about 31 miles northwest of Bordeaux. The cores were recovered from 966-970 m. (about 3,170 ft.).

The well is being taken deeper with plans for testing back up the hole later. Latest report listed the well as drilling at 1,043 m. (3,420 ft.). Earlier it encountered formations believed to be the Cenomanian of Middle Cretaceous at 870 m. (2,860 ft.).

At Parentis, about 44 miles southwest of Bordeaux, where the company made an apparent major field discovery last March, the No. 4 well about 4,000 ft. north of the discovery encountered the top of the Lower Cretaceous limestone at 2,201 ft. Previous wells have shown this thin upper limestone to be separated from the main dolomite pay by an impervious section some 150-160 m. thick. The No. 4 well is being cored through the entire section.

The No. 3 well has been placed on production with a potential of better than 3,300 bbl. daily. Earlier, the operator drilled out and reset the plug above the water contact at about 2,400 m. (7,850 ft.). Production from the discovery well and the No. 3 is limited by availability of tank cars and capacity of loading racks. Plans for a pipeline outlet for the field are under study. This line could lead to Bordeaux or farther north toward the mouth of the Gironde River.

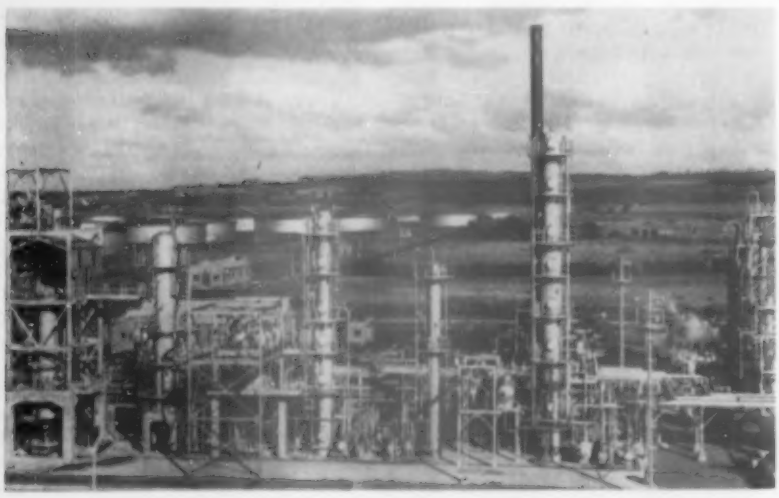
The rig used on the unsuccessful Parentis 2 well has been dismantled and is being moved to the location of another Esso exploratory test. This will be drilled in the Boulon district (Lot et Garonne).

New Units Complete Expansion

THE recent commissioning of three more units completes the major postwar expansion program at the Grangemouth, Scotland, refinery of Anglo-Iranian Oil Co., Ltd.

The final units are a 60,000-ton a year catalytic polymerization plant, a Girbotol unit, and sulfur-recovery unit. The recovery unit will produce about 14 tons of sulfur daily. The sulfur is trucked to the Broxburn oil works where it is manufactured into sulfuric acid for use in the chemical industry. Tetramer from the polymerization unit is used in the adjacent plant of British Petroleum Chemicals, Ltd.

The Grangemouth refinery was a plant of approximately 7,000 bbl. daily capacity when World War II ended. Construction since carried out by the company has raised capacity to about 54,000 bbl. daily. The refinery has a history going back more than 100 years when refining of shale oil was first started on the present site on the Firth of Forth.



CATALYTIC POLYMERIZATION plant recently completed at Grangemouth refinery.

Oil Claim Denied

Anglo-Iranian loses try to recover Iranian crude

A THIRD court has denied Anglo-Iranian Oil Co., Ltd., ownership of oil transported from the company's nationalized properties in Iran.

To date, Anglo-Iranian has won only one of four attempts to regain the oil. The single victory was won in a British court.

The latest legal setback came when a Rome court refused to grant Anglo-Iranian ownership of oil transported from Iran by an Italian company, Supor. Anglo-Iranian claimed in absence of compensation from Iran, the Italian company was dealing in what amounted to stolen property. The British firm was ordered to pay court costs.

In London, an Anglo-Iranian spokesman said the company has not decided whether to appeal.

Earlier cases . . . Previously, a Venice court refused to impound oil claimed by Anglo-Iranian and a Tokyo court rejected a similar request. Two Italian firms, Supor and Epim, and a Japanese marketing company, Idemitsu, sent tankers into Abadan during the nationalization and took out some 24 tankers of oil.

Anglo-Iranian won title to the first cargo lifted from Iran but this was granted the company by a British court.

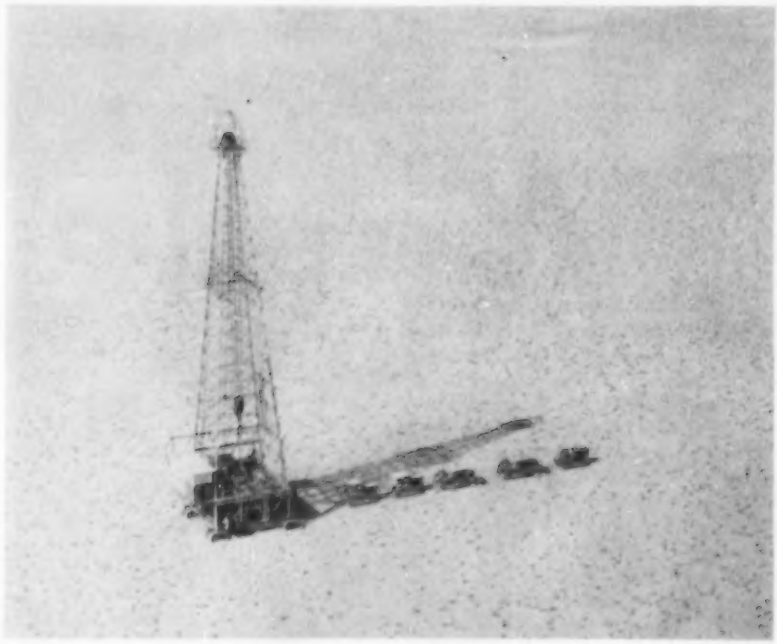
Since the suit was filed in the Rome court, Iran and a consortium of eight international oil companies have reached an agreement. Anglo-Iranian was awarded $70 million in compensation from the Iranian Government for losses suffered during the 3-year nationalization.

Shell To Expand Refinery

N. V. De Bataafsche Petroleum Mij. (Royal Dutch-Shell) is planning a second catalytic cracker at its Pernis, Netherlands, refinery.

The new fluid unit will have a capacity of about 33,000 bbl. daily. Construction is to begin at once, with completion scheduled in about 2 years. The new unit will duplicate the existing catalytic cracking unit and balance increased distillation capacity at the refinery.

B.P.M.'s Pernis refinery now ranks as the largest in Western Europe. It has a crude capacity of 200,000 bbl. daily, with 20,000 bbl. daily in thermal cracking and 33,000 bbl. daily in the existing catalytic cracking unit.



Old Record Dwarfed as...

...Rig Skidded 99 Miles

KUWAIT OIL CO., LTD., has set a new rig-skidding record by pulling a big rotary unit 99 miles across Middle East desert sands where the temperature ranged above 165° F.

Actual traveling time amounted to 40 hours, making an average speed of about 2½ miles per hour. The move was spread over a 9-day period, with operations suspended 2 days because of a Moslem festival.

The rig was moved in two loads, each load pulled by five tractors in tandem. The route covered 85 airline miles from Ahmadi near Burgan field to the location for a new wildcat in northern Kuwait, Raudhatain 1.

The move shattered the 17-mile skidding record set recently for a 136-ft. rig by Rumbaugh Construction Co. for Harry Bass Drilling Co. in the Permian basin of West Texas *(The Oil and Gas Journal, July 26, page 147)*. It also far surpassed what has been recognized as the record for small, jacknife-type rigs. Twenty-eight miles is regarded as the record for the small rigs.

What happened . . . In the 99-mile move, the first load weighing 110 tons consisted of a 136-ft. derrick and substructure, draw works, hoisting drum, rotary table, piping, and associated equipment. The second, 95-ton load was made up mainly of the engine unit and transmission half of the draw works.

The equipment was taken up three escarpments and over a number of shallow, dry stream beds. The two lead tractors were equipped with bulldozer blades and could be sent ahead for route preparation. Each of the two loads was mounted on a set of 34-in. forged-track wheels.

Water, food, and sleeping quarters for the moving crew were provided in auxiliary vehicles.

During the week covered by the move, Kuwait's average temperature was 165° F. in open sunshine and 107° F. in the shade.

Brazil Buys Crude

Venezuelan oil contracted for new plant at Cubatao

PETROBRAS (Cia. Brasileria de Petroleo, S.A.), the Brazilian Government's oil monopoly, has contracted with Standard Oil Co. of California and its subsidiary, Richmond Exploration Co., for the purchase of 3,500 bbl. daily of Boscan, Venezuela, crude oil.

Under the agreement, the American companies will underwrite the dollar cost of a plant to process crude for the production of 116,000 tons of asphalt annually. The plant will cost about $1,200,000, half of which will be dollar expense.

The plant will be constructed near the government's refinery nearing completion at Cubatao, near Santos. When the asphalt plant goes into full-scale operation, probably about December 1955, its production is expected to fill Brazil's need for this product.

The Cubatao refinery, under construction for 5 years, is scheduled to go into operation at the end of December or early in January. It will have a crude capacity of 45,000 bbl. daily.

The Richmond company produces about 37,000 bbl. daily of crude oil in Venezuela. Its major field, Boscan, on the western side of Lake Maracaibo, is a large reserve of heavy (10.5°-gravity) crude.

Second contract . . . Recent agreement is the second signed by the Standard of California organization for crude supply to Cubatao. Last April, its subsidiary, California Transport Corp., was awarded a contract to furnish 15,000 bbl. daily of Saudi Arabian oil for the main refinery. Esso Export Corp. received another 5-year contract to supply 30,000 bbl. daily of Tia Juana (Venezuela) crude for the plant.

The Cubatao refinery is one of two scheduled to go into operation about the end of the year in the Sao Paulo region.

A privately owned 20,000-bbl. daily refinery being built at Capuava on the outskirts of Sao Paulo is due to go into operation about the end of November. First shipment of Kuwait crude already has been received.

Both the Cubatao and the Capuava refineries were designed and engineered by Hydrocarbon Research, Inc.

Two Lines Near Completion

Work is scheduled to be completed in October on two pipelines, one of which will connect the Barrancabermeja refinery with the Colombian capital of Bogota.

Anderson Brothers Corp. is working on a 59-mile, 8-in. line which will connect Barrancabermeja with Cantimplora. Williams Brothers Overseas Corp. is ending the reconditioning of a 109-mile, 6-in. line from Puerto Barrio to Medellin.

Before Anderson Brothers began its work on the Barrancabermeja-Cantimplora line, the two points were connected by a 6-in. line of invasion pipe. When the line is completed, a pump station will be built on the Cantimplora side of the Magdalena River to pump products to Puerto Barrio where they will be taken into the line to Medellin.

Cuba Promising . . . Or Is It?

TWO firms entered the Cuban oil play with renewed vigor last week, following completion of the second successful well in the Jatibonico area.

Kerr-McGee Oil Industries, Inc., which drilled the wells setting off the boom, exercised its option to purchase a 25 per cent interest in the concession covering approximately 15,000 acres in the discovery area.

Almost simultaneously, Cuban-Canadian Petroleum Co. of Cuba purchased rights over about 15,000 acres offsetting the field on a checkerboard pattern. Cuban-Canadian is a wholly owned subsidiary of American Leduc Petroleum Co., Ltd., of Edmonton.

Cuban-Canadian purchased its interest from Petrolera Jatibonico, holder of the original concession in Camaguey province. Other half of the concession, known as "Dos Estrellas," was sold earlier to Corporacion General de Petroleo, which subsequently made the Echeverria discovery.

Kerr-McGee confirmed reports that Echeverria 2, 1,000 ft. northeast of the discovery, is a producer, but official results of production tests were not disclosed.

Cuban-Canadian's acquisition is its second major move in Cuba. Earlier, L. M. Birrell, president of American Leduc and chairman of the board of Cuban-Canadian, announced acquisition of a 30-year oil lease on nearly 5,000,000 acres scattered through five provinces.

CUBAN AMERICAN OIL CO. is expected to reach projected total depth of 4,000 ft. early this week at its first wildcat test in Cuba 15 miles northeast of Sancti Spiritus.

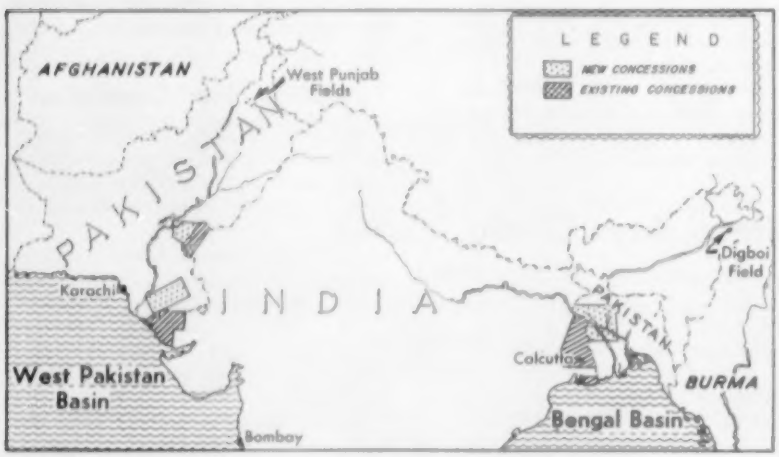
Latest report last week placed bottom of the hole at 2,800 ft. Operator was drilling ahead at a rate of about 300 ft. a day and coring all sand breaks. No shows have been encountered.

Location of the test, the 1 Adelaide, in Cuba's central basin is only about 8 miles northeast of the Jatibonico discovery near the Las Villas and Camaguey province boundary. Production was established at this well in a 30-ft. sand section, thought to be of Cretaceous age, at about 1,080 ft.

Big concession . . . Cuban American, headed by Tevis Morrow, Los Angeles, in combination with the Grady Vaughn-H. W. Klein interests of Dallas, holds a 750,000-acre exploratory concession in Cuba and an option to select another 750,000 acres within a year from the spudding of the first wildcat, September 23.

The company obtained the acreage through an agreement with two Cuban national companies, Trans-Cuba Oil Co. and Cuban-Venezuelan Oil Voting Trust, which control 17,000,000 prospective oil acres in the country.

Most of the acreage selected by the company lies in the central basin, with the remainder in the eastern basin.



Standard-Vacuum Concessions in Pakistan

Extensive geophysical and geological work is planned by Standard-Vacuum Oil Co. on concessions recently acquired in East and West Pakistan. The concessions, covering about 20,000 sq. miles, are across the border from concessions obtained by the company earlier from the Indian Government. Under the agreement with Pakistan, the government will provide 25 per cent of funds for exploration and will have a similar share in any crude oil discovered. (The Oil and Gas Journal, October 4, page 122).

Pemex Prices Hit

Government shuns protests to high cost of gasoline

DESPITE widespread public protests, the Mexican Government has refused to withdraw its recent order permitting increases in the price of Mexican gasoline to counteract last spring's devaluation of the peso.

Truck and taxi drivers in Tampico, Madero, and Victoria were so incensed by the higher fuel prices posted by Petroleos Mexicanos, the government oil monopoly, that they blockaded city streets.

Tampico, hardest hit by the blockade, returned to normal when 1,500 protesting truck and taxi drivers went back to work following a 5-day demonstration.

After conferring with Angel Carvajal, Mexico's interior minister, strike leaders indicated the price increase would be cut. But there was no confirmation from the government, which previously had said the raise would stick.

Because of the blockade, some tourists from the United States reportedly were forced to spend a night in their automobiles outside Victoria, a main stopping point along the Pan-American Highway to Mexico City.

Background . . . The government lowered the exchange rate for the peso from 11½ to 8 cents in U. S. money last April. At that time, government leaders promised the public that prices would be kept in check except on imported commodities. In line with this policy, Pemex was not permitted to raise its prices.

Pemex makes many of its expenditures in dollars, and the devaluation cut sharply into its dollar-equivalent income. The recent boost upped the price of gasoline an average of 30 per cent in northern Mexico, causing an increase in the Madero-Tampico area from 13 to 17 cents per gallon.

Soviet Discoveries Reported

Reports from East Germany tell of two recent oil discoveries in this Russian-controlled territory.

The Soviet drilling administration is moving in additional rigs to develop a discovery at Waddekath. Two wells drilled in this area obtained a production of around 215 bbl. daily each from about 5,085 ft.

At Ettersberg near Weimar, a wildcat is said to have given a production of about 85 bbl. daily from a depth of 6,200 ft. Two rigs are doing development work in the area of this discovery.

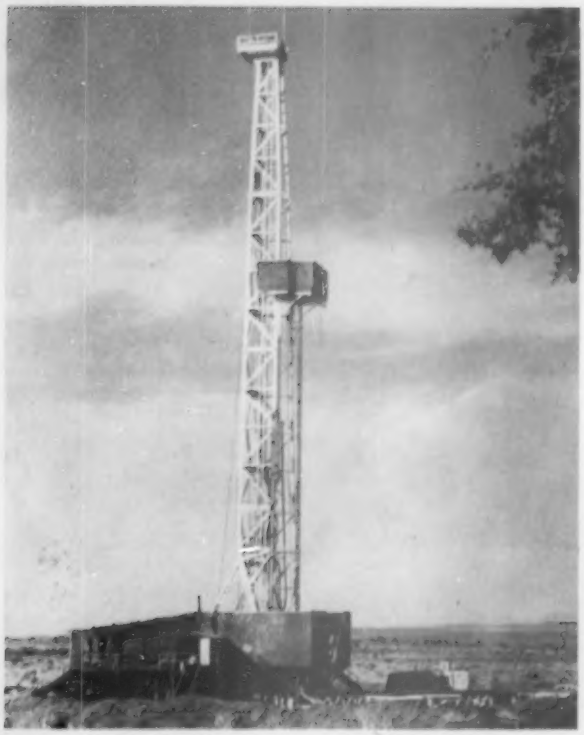
SPECIAL ...

1954 TOOL PUSHER'S REFERENCE

SPECIAL ...

DRILLING REPORTS ON TODAY'S ACTIVE AREAS

The Oil And Gas Journal



HARD-ROCK DRILLING like that encountered by this West Texas rig is still one of the biggest reasons why hole size cannot be reduced economically. Fig. 1.

AIR-DRILLING this Lea County, New Mexico, well to 3,600 ft. proved a money-saving means to reducing hole size. Two 5⅝-in. air-type bits drilled 1,103 ft. each. Fig. 2.

Are Your Drill Holes Too Large?

The old adage, "You've got to drill 'em big if you want to drill 'em deep," will still hold in most areas, but it may have to be modified for exploratory drilling in the future. Slim-hole drilling is picking up in medium-depth areas, and should pick up more in the next few years.

by Ed McGhee
Drilling-Production Editor

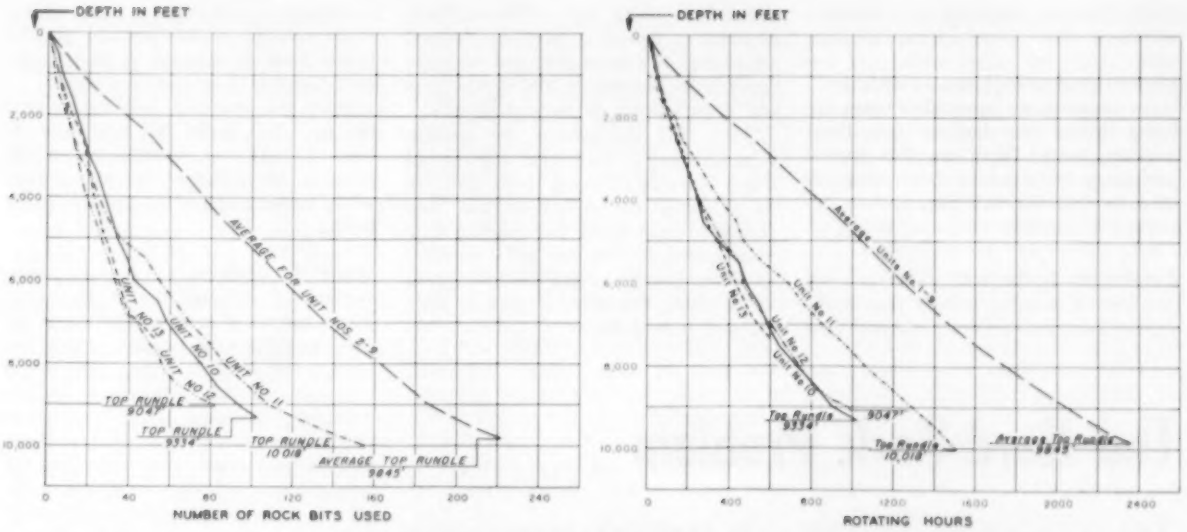
CUTTING the cost of deep wells by drilling small-diameter holes with light rigs has always been an intriguing idea to oil producers. Slim-hole talk is stronger today than ever. Drilling contractors are wondering if this is merely another of the periodic upsurges that will gradually die down as in the past, or if this really indicates a coming widespread trend.

The truth probably lies somewhere in between the two extremes. Operators will discover an increased number of areas in which it is economically possible to reduce hole size. This will be especially true in exploratory wells where the odds are against the need for an oil string. However, for medium and deep development wells, it is doubtful that future hole sizes will be appreciably changed from current practice. The same is true for wildcats in known crooked-hole and hard-rock country.

Prospect is good . . . The general economic prospect of reducing hole size is better today than ever before. The reasons for that lie mostly in improvements of equipment and technique that could be expected to come with time. Jet bits in smaller sizes appear to be proving successful, and oftentimes increase penetration rates appreciably. Improved bearings in all size bits are allowing longer runs than were possible a few years ago.

The part played by mud hydraulics is better understood and more appreciated. As a well goes below 6,000 or 7,000 ft., mud-pump pressure goes up as a result of the high volume of mud needed to carry cuttings up the annulus. The larger the annulus, the larger the required mud volume, and the higher the pump pressure. So, generally speaking, a smaller hole size reduces the amount of mud that has to be circulated to remove cuttings, and, thereby, reduces pump pressure. Less pump pressure and less mud volume mean a cheaper pump.

Air drilling may help . . . The past 2 years have demonstrated that increased penetration rates and longer bit life can almost always be expected as a result of using air or gas as a circulating fluid. That fact applies regardless



Wells 2 to 9 drilled standard hole with standard drill collars. The latter wells in the field drilled 12¼-in. hole with 11¼-in. drill collars. The big sizes are now considered standard. Figs. 3 and 4.

of hole size. Moreover, in small-diameter holes the use of air or gas should allow less weight to be carried on the bit while still drilling at satisfactory rates. It is, therefore, not unlikely that hole sizes will decrease in any area where air or gas can be used as a circulating fluid.

One objection to slim holes raised by production men in the past has been the difficulty of most producing and workover operations inside small casing. The permanent-type completion, by introducing a whole new series of small-diameter tools, eliminates many of these specific objections. It seems almost inevitable that the permanent-type completion will be put to wider usage, and the result may encourage reduced hole sizes in some areas.

Slim holes create fishing problems, but much progress in tools and techniques has been made in that direction during the past several years.

Same known advantages . . . Of course, the cost-saving features of reducing hole size that were known 5 years ago are still attractive today. First, moving from location to location is faster and cheaper with a light rig than with conventional equipment, especially in rugged wildcat country. Day time on the smaller rig is low because the contractors' investment and operating expenses are low.

Casing, always an expensive item, goes down in price as size decreases. The same applies to cementing costs. Volume of the mud system can be smaller, and thereby cheaper to maintain.

Tool Pusher's Reference

Same old drawbacks . . . On the other side of the ledger, these are the main drilling problems that can prevent any real money saving from reducing hole size. First, in hard-rock country, the operator who tries to drill a small-diameter hole may find his costs going up faster than his hole is going down. His small bit probably will not carry enough weight to permit a satisfactory rate of penentration.

Secondly, an even worse situation develops when the formation has crooked-hole tendencies. There simply may not be enough room in the small hole to carry big enough drill collars to keep the hole straight, and still maintain money-saving penetration rates.

Oddly enough, in extremely soft formations a small hole may not be as cheap as a large one. The small-diameter bit may not carry long enough teeth to drill as fast as the formation will permit. Therefore, drilling rate is not as fast as it could be.

In the event a producer is made in a small-diameter hole, a suitable casing may not be available for the particular hole size. So, in many instances, the successful slim-hole wildcat must be reamed to a larger size, or an entirely new hole drilled. This casing problem should resolve itself in time.

Finally, there is the case of the well which unexpectedly encounters a formation or hole condition that must be cased off before drilling can continue to total depth. Confronted with this problem, the operator may find himself unable to set that needed intermediate casing string although he was drilling with standard-size bits. For that reason, many operators contend that there is little to be gained by reducing hole size except aggravating the chances of being "cased out of the hole."

Current Exploratory Programs

There are at present several operators conducting extensive slim-hole exploratory programs. The Denver-Julesburg basin has been the scene of small-diameter hole drilling by at least three major operators in the last year. One of these companies is now uncertain whether it will continue its program. It is reported that the savings from the slim holes was small, and that the contractors are reluctant to continue the program. However, this operator still has one rig active in slim-hole exploration in that area.

Better success has been reported from another major operator in the Denver-Julesburg basin. No reason is apparent for the reported success, but the program is continuing. The same operator is conducting a one-rig stratigraphic evaluation in the Williston basin in North Dakota. The holes are 6¾ in. in diameter, about 3,000 ft. deep, and are completed in 7 days or less. The rig was recently on the eleventh of what is reported to be a 25-well program.

At least one major company has drilled a number of small-diameter exploratory wells along the Gulf Coast during the past year. It is reported that the program will be continued and possibly enlarged.

Shallow slim holes popular . . . California producers are watching with interest the results being obtained in drilling 2¾-in. holes with a "micro rig." *(See the Oil and Gas Journal, May 31,*

1954). This may prove to be a valuable technique for "strat" tests, locating water strata for water wells, and for general shallow exploratory work.

As in the past, many slim holes are being drilled for shallow water-flood injection wells. There are also several producing areas where 2-in. tubing is used to drill the well and is then cemented in the hole as the oil string.

Contractors in the act . . . Within the last 3 or 4 months, at least two major drilling contractors have purchased new slim-hole drilling rigs. One of these contractors had only recently stopped submitting bids on shallow and medium-depth holes because of stiff competition and price cutting on those contracts.

That stiff competition for drilling contracts may in itself deter any current trend toward reducing hole size. In most areas, the operators are now getting more hole for their money than ever before. If they can get a standard size hole cheaply, there doesn't appear to be much incentive to gamble on a reduced hole diameter.

The Hard-Rock Problem

THE country's second most active drilling area is that of West Texas and New Mexico. It is also our best example of hard-rock drilling, and it is not uncommon there for drillers to carry as much as 70,000 to 80,000 lb. on 7⅞-in. bits. That tremendous load is a real test on bit bearings, but high weight is necessary to get the fast drilling rates that competition demands. Fortunately, the 7⅞-in. bit is large enough to carry bearings that will stand up to long runs at high weights.

Reducing the hole size to 6¾ in. and carrying proportionately less weight (say 55,000 to 65,000 lb.) should get the same drilling rate, but bit runs would be sharply decreased. Round-trip and total bit costs would probably go up.

As a rule of thumb, a bit will drill most formations at rates in direct proportion to the amount of weight carried. In other words, cutting the weight on bit in half will usually cut the drilling speed in half. It is also true that for a given weight on bit, drilling rate depends directly on the size of the bit. This means that a small bit could be expected to drill at exactly the same rate as another bit that is carrying twice as much weight but is also twice as large.

Load down with bit size . . . Unfortunately, small bits cannot carry as much weight for their size as a big bit can. In any bit, the space for bearings and for teeth is limited by the over-all diameter. There simply isn't enough space in a small bit to get a large enough bearing to carry high weights. The result is that a small bit will not make as many feet of hole as a conventional-size bit before it must be pulled.

Bit manufacturers cannot, of course, say that there is an exact, critical size below which a bit is too small to carry the optimum bearing. However, they will admit that their design problems are considerably simplified in sizes larger than 6⅜ in.

Slim hole drilled with air . . . One technique that may make reduced hole size attractive in hard-rock country is the use of air instead of mud as a circulating fluid. Humble Oil & Refining Co. in a recent Lea County, New Mexico, well used air to drill and core a 5⅝-in. hole to more than 3,600 ft. *(See The Oil and Gas Journal, August 16, 1954).* Main purpose of using air was to obtain better cores; and cores recovered were subsequently reported to be better than could have been expected with mud in the hole.

Two equally important results were also found from the air drilling. First, bit life was better than would have been the case with mud. Two air-type 5⅝-in. bits drilled an average of 1,103 ft. each. The average for 13 other wells in the area drilled with mud showed runs of only 237 ft. per bit.

Moreover, the air-type bits drilled at an average penetration rate of 24.7 ft. per hour as opposed to 16.6 ft. per hour for the 13 mud-drilled wells.

Four and one-half inch casing was run to 3,580 ft. in this hole, and 30 bbl. of mud was spotted before cementing. No difficulty was encountered while running nor while cementing the casing.

Water is problem . . . Until some method is perfected for drying up a hole when water or oil enters, air or gas drilling will not be possible, much less economical in most areas. One major company recently attempted in two southern Oklahoma wells to improve penetration rates with air drilling. However, in both cases, water entry into the hole made it necessary to revert to the use of mud within only a few score feet.

Another extremely hard-rock drilling area, northwestern Arkansas, has been the scene of experiments with the use of engine-exhaust gas for drilling. *(See The Oil and Gas Journal, May 31, 1954).* Phenomenal increases in penetration rates for several hundred feet of hole were reported with this technique. However, water entry into the hole has always eventually made it necessary to revert to mud; and a thorough evaluation of this method is, therefore, impossible.

Still await "gadget" . . . The oil industry has been waiting many years for the perfection of a combination rotary and percussion drill. Much laboratory work is still being done on a variety of thus far unsuccessful instruments. In the event such a gadget is finally made practical, no one is certain that it could be run in a small-diameter hole. However, if such a combination rotary-percussion tool is developed, and if it can be run in small hole, we may see a reduction in hole size for hard-rock as well as all other areas. The chances appear very slim at present.

The Crooked-Hole Problem

DRILLERS have long regarded as true what Arthur Lubinski and H. B. Woods proved about drill-collar size in their theoretical work. *(See The Oil and Gas Journal, May 31 and June 7, 1954).* That is, in crooked-hole country, big stiff collars tend to keep hole straight; small, limber collars tend to let the hole drift off vertical. Clearance between the collars and the hole even becomes relatively unimportant in the most severe crooked-hole formations.

The driller on a slim hole may find that he can't run big enough collars to drill at a satisfactory rate while maintaining a straight hole. As a result, drilling proceeds with reduced weight on bit, and at reduced penetration rates. In such cases, day rates on the light rig have to be extremely low to be com-

petitive with conventional equipment.

Big collars in big hole . . . There is, of course, a practical limit to the size of drill collars that contractors are willing to use. However, where the crooked-hole problem is acute, the trend is certainly toward larger collars in larger hole. The outstanding example of this trend is Jumping Pound field, of Alberta, Canada. In that field Shell Oil Co. is using 11¼-in. collars in 12¼-in. hole. *(See The Oil and Gas Journal, July 26, 1954).*

Jumping Pound field presents one of the most severe crooked-hole problems facing the industry. There is 6,000 or 7,000 ft. of Cretaceous formations in which formation dips up to and including 90° have been encountered. The remaining sections above the pay at 10,000 ft. are extremely hard and also present crooked-hole tendencies.

Prior to the use of the 11¼-in. collars, Shell drilled nine wells that required an average of 173 drilling days each to reach the pay. Special tools including a percussion drill had been unsuccessfully tried. But the first well using the big collars reached total depth in 50 fewer drilling days than before. Not only that, but hole deviation was better controlled. Figs 3 and 4 are rotating hour and bit records for wells before and after the use of the big collars.

Shell now considers the use of the 11¼-in. collars in 12¼-in. hole as standard practice. Moreover, it is not unlikely that hole size will be further increased so that even larger collars can be used.

Fishing problem arises . . . It has been necessary to fish for the large collars several times, and each time thus far they have been recovered. However, at no time has it been considered that the big collars were themselves responsible for the fishing job all trouble was reported up the hole.

The problem of fishing for collars in a "packed hole" is much the same whether the hole is oversize, conventional size, or undersize. However, this difficulty is being lessened by advances in fishing tools and techniques. One spectacular case occurred in West Texas recently where a string of 7-in. drill collars was stuck in 7⅞-in. hole. The collars were washed over and recovered. Admittedly, the washover pipe had thin walls, but the collars were recovered.

Those who advocate so-called "oversize drill collars" point out that with the big collars there are likely to be fewer sudden changes in hole direction. Fewer changes in hole direction, or doglegs, means fewer key seats; and fewer key seats mean fewer fishing jobs. Moreover, if big collars will assist in getting to total depth faster, they should help in preventing fishing jobs. Less time in the hole gives less chance for trouble to arise.

Eola is bad too . . . Eola pool, of Garvin County, Oklahoma, presents a crooked-hole problem equally as bad as that in Jumping Pound field. At Eola, in order to keep the hole straight it is necessary to reduce weight on bit so much that drilling rates are sometimes almost negligible. One rig was setting pipe at 9,750 ft. on September 1, 1954, after having been on the well continually for more than 300 days.

The first footage contract let in Eola was negotiated in early summer of this year at a price of approximately $25 per foot.

One contractor is reported to be considering increasing collar size to 8-in. diameter in the effort to keep his hole straight while still drilling at acceptable rates. Hole size at Eola is more likely to increase than to decrease.

Soft-Formation Drilling

FOR the same reason that small bits cannot carry better bearings, they cannot carry long cutting teeth. There just isn't enough space. Long teeth on a big bit will often drill the very soft formations at rates that can't be matched by the small bit in terms of time or money.

There are areas, like some parts of the Gulf Coast, where many wells encounter no particularly hard drilling and no pronounced crooked-hole tendencies. Drilling a deep well is mostly a matter of keeping the bit on bottom, setting enough weight on it, and turning it to the right. Naturally, the bit can't take a bite any bigger than the length of its cutter teeth. So, any time the teeth are so short that they will not take as big a bite as the formation will allow, drilling is slower than it could be.

Weeks Island is example . . . One currently active field that shows how fast the softer formations can be drilled with big bits is Weeks Island field on the Louisiana coast. Humble and Shell have drilled Weeks Island wells to 14,000 ft. and set strings of 9⅝-in. casing in less than 35 days. *(See The Oil and Gas Journal, October 5, 1953).* As few as thirty-five 12¼-in. bits are used to drill out from under the surface pipe at about 2,900 ft. to the intermediate casing point of around 14,000 ft.

The need for large-diameter hole at Weeks Island is, of course, that the wells are completed at intervals ranging deeper than 17,000 ft. and require an intermediate casing string. However, drilling 14,000 ft. of 12¼-in. hole in 35 days is fast digging in anybody's oil patch.

This is not to say that the fast drilling at Weeks Island is due solely to the fact that the hole is large diameter. Good drilling practices, high horsepower on all equipment, and an excellent mud program, all contribute to increasing the penetration rates. But is still doubtful that this performance could be matched if hole size were drastically reduced.

"What's so interesting about nature that makes you guys stop drilling?"

Tool Pusher's Reference

How they drilled Houma 1 Community . . .

The Tide Water 1 Houma Community is located on the edge of the city limits. Bottom of directional hole landed out of picture at lower left at measured depth of 14,128 ft., and vertical depth of 13,550 ft.

. . . the longest section of deviated hole ever drilled

by J. E. Bailey

COMPLETION of Tide Water Associated Oil Co.'s Houma, La., 1 Community as a gas producer marked the successful completion of an attempt to control the longest section of deviated hole ever drilled. The deviation was controlled from 1,004 ft. to a measured depth of 14,128 ft. and a vertical depth of 13,550 ft.

There are approximately 2,200 lessors on this well. Together with practically all of the city-owned property, there is represented 96 per cent of the individually owned property within the city of Houma. The directional hole had been indicated since a city ordinance forbade drilling within the city limits.

Previous drilling by Tide Water on the Southdown Sugars, Inc., plantation south of the city had proved production in the Krumbhaar and Southdown sands. The Krumbhaar sand is a normal-pressure gas sand found at approximately 12,400 ft. The Southdown sand is an abnormally high-pressure gas sand found at approximately 14,200 ft. The Southdown sand has a calculated bottom-hole pressure of 11,700 psi., giving a pressure gradient of approximately 0.82 psi. per foot of depth.

Hits two targets . . . Because of the semiexploratory nature of a well bottomed under the city it was desirable to design the directional well with the

City fathers conceived the plan

THE achievement described here assured a royalty income to many Houma property owners and to the city, and eliminated the necessity of an impending rate increase to all customers served by the municipally owned gas company. Through the foresight and tenacity of the mayor and aldermen, an advantageous lease situation was made possible under this diversified mineral ownership.

Initiation of the project had been precipitated by the fact that the contract for gas to supply the city's distribution system was expiring and it was anticipated that the price of 16.2 cents per M.c.f. would be increased to at least 25 cents per M.c.f. In an effort to secure natural gas at a price low enough to prevent a rate increase, plus resulting lease bonus payments and royalty income should there be a productive gas structure, the city government, led by Mayor Leon Gary, had devised the plan.

Terms of Lease

The program was to get all individual property owners and the city to execute a community lease and authorize the mayor and aldermen to assign this lease to the oil company offering the best advantage to the city as a unit. After an intensive campaign of informing the people and stressing the necessity of unified action, the plan was successfully inaugurated, as evidenced by the large percentage of individual property owners who signed.

The terms of the community lease provided that 75 per cent of the property owners must sign by November 15, 1953, or the lease became void. The deadline was met and the city government solicited bids on the basis of bonus, royalty and price of gas to be furnished the city.

After a careful analysis by the mayor and aldermen, with the help of Fred Simmons, a consulting engineer and geologist, Tide Water Associated Oil Co. was awarded the lease on December 29, 1953. The terms of the lease provided that a well to be bottomed underneath the city must be commenced within 3 months after the formal approval by the State Mineral Board.

Tool Pusher's Reference

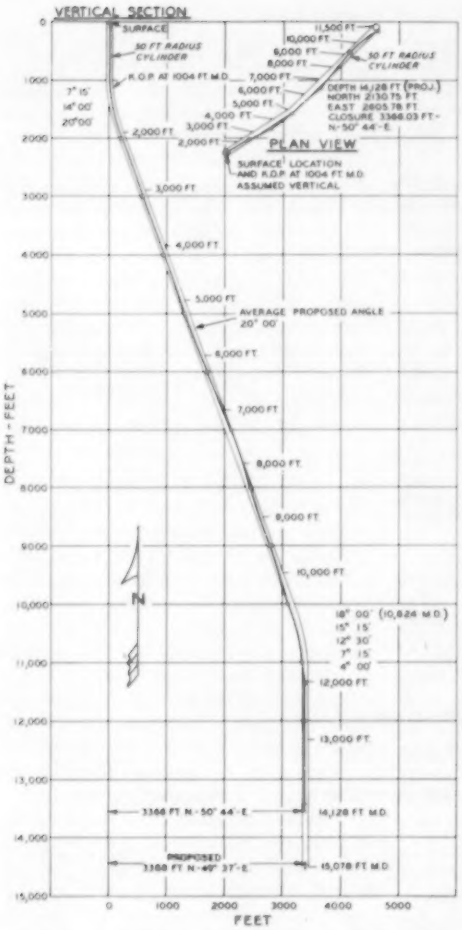


Fig. 1—This vertical section and plan view show how the deviated course of the well was kept inside the proposed limits.

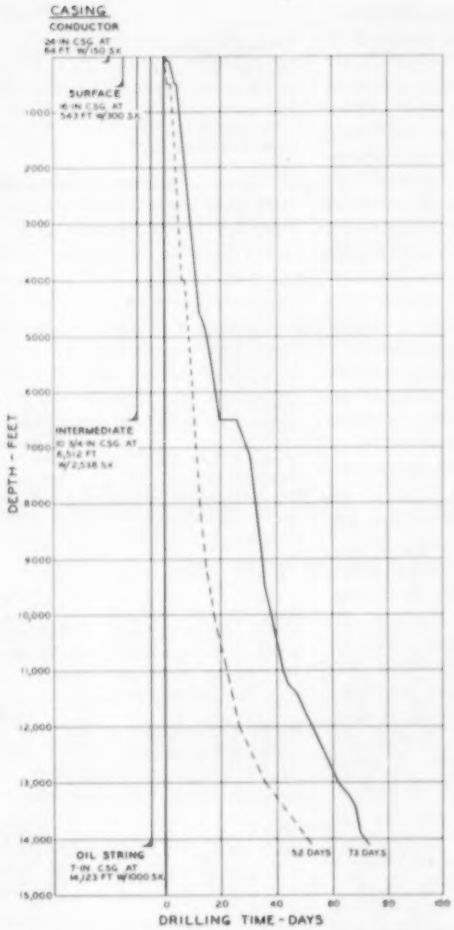


Fig. 2—A comparison of drilling time of Houma Community No. 1, which had longest section of deviated hole ever drilled, and an average "straight" hole (dotted line).

optimum bottom-hole location on each of the two sands as targets to lessen the chances of a dry hole. When the ideal geological location for each of the sands was picked it was found that they were directly in line vertically. After a careful study of aerial photographs and on-the-ground observations, it was found that the closest surface location outside the city limits from which this well could be drilled without the possibility of danger to residences or schools was on the Southdown Sugars property some 3,400 ft. southwest of the desired subsurface location.

To hit the sands on target it was necessary to start deflecting the hole as soon as practical in order to keep the deflection angle low and minimize the hazards in drilling and running casing. Fig. 1 shows the vertical section and plan of the desired tract of the well and the actual tract of the well as determined by directional surveys while it was being drilled.

Previous experience had shown that it is necessary to set a string of protective casing at a vertical depth of approximately 13,500 ft. in order that heavy enough mud might be carried to hold the high-pressure Southdown sand. A completion in the Southdown sand would then require either a 5-in. liner or a full string of 5-in. casing. Normal drilling in the area does not require more than 3,000 ft. of intermediate casing. It was thought desirable, however, to case as much of the deviated hole as possible to minimize the directional-drilling hazards. For that reason it was decided to run intermediate casing to a depth of 6,500 ft. Five hundred feet of surface casing and 90 ft. of conductor pipe were planned.

Drilled with steam rig . . . Loffland Brothers Drilling Co. was engaged to drill this well and the firm moved in its rig No. 61. This steam rig has a 136 by 30-ft. derrick, an Ideal 3410½ F.E. draw works powered by a 14 by 14-in. engine, a 12 by 12-in. underfloor rotary-table-drive engine, one Oil Well 320 and two National 20-in. steam mud pumps, and four 350-psi. w.p. boilers. The blowout-prevention equipment consisted of two Cameron Q.R.C. ram-type preventers and a Hydril preventer.

The well was spudded on April 14, 1954. Ninety-three feet of 24-in. conductor pipe was set and cemented with 150 sacks of common cement in a 27½-in. hole.

On April 16, the well was drilled to 555 ft. with a 12¼-in. fishtail bit and reamed to 20-in. with a pilot bit. At this point 16-in. casing was set at 543 ft. with 300 sacks of a 50-50 cement Pozmix mixture. After drilling out from under the 16-in. casing, the natural mud was replaced with red mud emulsified with 10 per cent diesel oil which was maintained at the following approximate properties: weight 10 lb. per gal.; A.P.I., 1 qt. out, funnel viscosity, 40 seconds; and water loss, 10 cc. A.P.I.

A 12¼-in. hole was drilled to 1,018 ft. where the first whipstock was set. After setting whipstocks at 1,434 and 1,700 ft., the hole reached the desired 20° drift angle at approximately 2,000 ft. The drift angle was maintained at

Tool Pusher's Reference

THE AUTHOR

John Edwin Bailey is division petroleum engineer, southern division, for Tide Water Associated Oil Co. A Louisianan by birth, Bailey studied engineering at Tulane and Rice. He joined The Texas Co. at Port Neches, Tex., in 1917. Following service in World War I, he joined Pure Oil Co. In 1934 and 1935, during the hectic days of the East Texas boom, he was a petroleum engineer with the Texas Railroad Commission in Kilgore and for the following 2 years in Austin as chief petroleum engineer for the Oil and Gas Division. He joined Tide Water in 1937 as a division engineer, and was later advanced to assistant superintendent of production.

approximately 20° without difficulty. Whipstocks, however, were required at 3,575, 3,844, 4,520, 4,671, and 5,280 ft. to obtain the proper drift direction to the intermediate casing point. After drilling a 12¼-in. hole to 6,520 ft. and reaming to 15 in., a string of 10¾-in. casing was run and cemented at 6,512 ft. with 2,538 sacks of common cement with 6 per cent gel. This string of casing was equipped with centralizers from top to bottom spaced approximately 85 ft. apart. The casing also had a stage-cementing collar at 3,494 ft. Eleven hundred thirty-eight sacks of cement were displaced out the bottom of the casing and 1,400 sacks were displaced out the stage collar. Cement return to the surface was obtained.

All footages are measured depths unless otherwise indicated.

A 9⅝-in. hole was drilled below the 10¾-in. casing. The drift angle of 20° to 24° was still being maintained without difficulty below the 10¾-in. casing. It was again necessary, however, to set whipstocks at 6,719 and 6,845 ft. to control direction. At 8,600 ft. the mud was converted to a lime-base mud and the properties maintained at 12.5 to 13 lb. per gal. weight, funnel viscosity of 50 to 60 seconds, a water loss of 2 to 4 cc., a pH of 13, and 10 to 12 per cent diesel oil.

Getting back to vertical . . . Original plans called for maintaining the 20° angle to 10,788 ft. and then dropping it back to vertical at the angular rate of 2° per 100 ft. The closure was ahead of schedule at 8,000 ft. due to the drift angle having averaged slightly over 20°. The drift angle was therefore permitted to fall off at that point to approximately 18°. From 11,000 to 12,400 ft. the hole was straightened up to a drift angle of less than 1° for an average rate of angular change of slightly over 1° per 100 ft. It was thought desirable to keep this rate of drift-angle change as low as possible to minimize the hazards in drilling the remaining vertical section of the hole and running the 7-in. casing.

The well was drilled with a drift angle of less than ½° from 12,400 ft. to a total depth of 14,128 ft. At a depth of 13,700 ft. powdered graphite in the amount of 4 lb. per barrel was added to the mud. The true vertical depth at the measured depth of 14,128 ft. is 13,550 ft. The 7-in. casing was set and cemented at 14,123 ft. with 1,600 sacks of slow-set cement with 4 per cent gel. The 7-in. casing was a mixed string of 26 and 29 lb. per foot, deep-well grade with long threads and couplings. No centralizers or scratchers were run on the 7-in. casing. The casing was landed with no difficulty whatsoever and good returns were observed throughout cementing.

It is believed that the increased hole lubrication as a result of using the graphite contributed materially to the success in running the 7-in. casing. The procedure used was the same as that used in running casing in a straight hole at this depth. Conventional float equipment consisting of a float shoe and a float collar was used with the float collar located one joint above the shoe. The casing was run in 8 hours and each joint was filled while running in the hole.

After cementing the casing, a temperature survey was run which located the top of the cement behind the casing at 7,750 ft. Between the time this well was spudded and the time the 7-in. casing point was reached, a decision had been made to delay the development of the deeper Southdown sand. This temporary delay in the development of this extremely high-pressure reservoir is to permit the completion of studies in progress to determine the equipment and procedure to use in drilling and completing these wells to insure complete safety. Setting the 7-in. casing at 14,123 ft. in the 1 Houma Community leaves the well in good shape to deepen on to the Southdown sand, should this be desired at any time in the future.

Completed after isolation . . . Electrical and radioactivity logs on this well indicated that the lower Krumbhaar sand section was encountered 12,968 to 13,073 ft. Before perforating the casing at this interval for production, the casing was perforated 13,022 to 13,024 ft. below the anticipated producing interval for a precautionary squeeze and squeezed with 85 sacks of slow-set cement to a maximum pressure of 5,500 psi. The casing was then perforated 12,950 to 12,952 ft., above anticipated producing interval for a precautionary squeeze and squeezed with 240 sacks of slow-set cement to a maximum pressure of 5,500 psi. Cement was drilled to 13,006 ft. and casing perforated 12,972 to 12,996 ft. opposite the Krumbhaar sand with four jet shots per foot for production. A retainer-type packer was set at 12,940 ft. with a wire line.

TABLE 1—MUD PROGRAM

Mud type—	From	To	Lb./gal.	Vis.	Water loss	pH	Chemicals
Natural	0	500	Natural	Natural	....	..	Caust. & Queb.
Red emulsion, 10%	500	6,500	10-10.5	40-45	15-12	8	Caust. & Queb.
Red emulsion, 10%	6,500	9,000	10-10.5	40-45	12-8	10	Caust. & Queb.
Lime emulsion, 10%	9,000	13,700	10.5-13	40-45	8-3	12+	Caust. & Queb.
Lime emulsion, 10%	13,700	TD	12.5-17	45-60	3	12+	Caust. & Queb.

Remarks: Add 10 per cent diesel at 500 ft. to aid in whipstocking hole at approximately 1,000 ft. to obtain 20° deflection by approximately 1,800 ft. Add 4 lb. of graphite per barrel of mud at 13,700 ft.

CASING PROGRAM

Grade—	Size (in.)	Set (ft.)	Weight (lb.)	Hole size (in.)	W.O.C. time (hr.)	Cement
Armco S.J.	24	94	63.7	27½	24	150 sacks common
J-55 S.T.&C.	16	543	65	20	24	300 sacks 50-50 Pozmix cement
	10¾	6,512	....	15	24	2,538 common +6% gel
	From	To				
Range 3, S-80 S.T.&C.*	0	1,646	55.5	....	..	.....
Range 2, N-80 S.T.&C.	1,646	2,480	51	....	..	.....
Range 2, J-55 S.T.&C.	2,480	3,495	45.5	....	..	.....
Baker stage collar	3,495	3,497	....	....	..	.....
Range 2, J-55 S.T.&C.	3,497	....	45.5	....	..	.....
	7	14,123	....	9⅝	24	1,000 slow-set +4% gel
	From	To				
Range 3, D.W. Buttress	0	1,100	29	....	..	.....
Range 3, D.W. L.T.&C.	1,100	3,061	29	....	..	.....
Range 3, D.W. L.T.&C.	3,061	14,123	26	....	..	.....

*W/75 centralizers.

TUBING PROGRAM

Range 2, 9% nickel w/type Hydril C-S thread	2⅜	12,940	4.7	....	..	.....

BIT RECORD

No.	Size (in.)	No.	Size (in.)
1	27½ 3-blade	8	12¼ Rock bits
1	15 Pilot bit	35	9⅝ Rock bits
1	12¼ Fish tail	1	6⅛ Rock bits

Tool Pusher's Reference

A string of 9 per cent nickel tubing with Hydril C-S couplings was run. Before seating it in the packer, the drilling mud was displaced from the tubing-casing annulus with a 12.8-lb. per gal. bentone completion mud. The tubing was then seated in the packer and the well brought in and cleaned up.

On test after cleaning up, this well produced at the rate of 5,000 M.c.f. per day on a 14/64-in. choke with a flowing tubing pressure of 3,900 psi. The well was shut in pending the completion of producing facilities and has a shut-in tubing pressure of 4,800 psi. The tubing was pressure tested on the rack to 11,000 psi. and the couplings were also tested to 11,000 psi. as the tubing was run.

Right on target . . . It will be noted from Fig. 1 that the actual tract of this well followed the planned tract very closely. This was done by the use of 10 whipstocks. The drift angle was successfully controlled with the drilling string hookup. Most of the whipstocks were for control of the drift-angle direction which followed the natural tendency to vary to the right (clockwise). All except two of the whipstocks were set while drilling the 12¼-in. hole prior to setting the 10¾-in. casing.

Both conventional and full-gage whipstocks were used depending upon the results desired. A 9-in. bit was used in drilling off of the full-gage whipstocks in the 12¼-in. portion of the hole and a 6-in. bit was used in drilling off of the conventional whipstock in the 9⅝-in. hole. After the conventional whipstocks were pulled, they were usually followed by a hole opener. All of the full-gage whipstocks were run while drilling the 12¼-in. hole. When the whipstock was removed, drilling was continued with a regular 12¼-in. bit.

The typical drilling hookup while building angle was a bit, stabilizer, 4½-in. by 14-ft. Monel pup joint, and 4½-in. drill pipe. When it was desired to reduce the rate of drift-angle change or rate of drift-angle direction change, the 14-ft. Monel pup joint was replaced with a 20 to 25-ft. Monel drill collar. A 7¾-in. collar was used in the 12¼-in. hole and a 6¾-in. collar in the 9⅝-in. hole. When it was desired to hold the drift angle and drift-angle direction constant, two steel drill collars were added to the string above the Monel collar. When it was desired to reduce drift angle and bring the well back to vertical, the stabilizer was removed and the Monel and steel drill collars left in the string.

The above-described techniques for controlling the hole are of a general nature and were changed slightly upon occasion when, in the judgment of the directional drilling engineer, a different hookup was necessary to obtain the desired results.

With conventional practices . . . While this was the longest section of controlled deviated hole ever drilled, it required no unusual techniques or equipment. It is considered a very risky practice in drilling a deviated hole to have more than 7,000 ft. of open hole with 5,000 ft. or less being desirable. When total depth was reached in the 1 Houma Community there was over 7,600 ft. of open hole below the 10¾-in. casing. In an attempt to keep the open hole in as good condition as possible, two "in the string" blade reamers were run. The first one was run 4,600 ft. off bottom when the well was at a total depth of 11,138 ft., and the second was run 1,100 ft. off bottom when the well was at a total depth of 11,214 ft.

There were no fishing jobs on this well, and the drilling rate was higher than expected. Fig. 2 is a drilling-time curve and for this well compared with the curves for two vertical wells drilled to this depth in the field. Table 1 summarizes the mud program, details of casing and tubing strings and the bit record for the 1 Houma Community.

Good Fishing Tools Are Good Business

by Ray F. Huber

THE oil industry today is much more in need of good fishing tools—and good fishing-tool operators — than it was 30 years ago. Wells are drilled three to five times deeper nowadays, and the added stress and increased complexity of operation that have resulted demand better tools and better men to operate them.

True, we still use many tools that were in use in the 1920's. Tools like overshots, spears, diamond points, and others. But practically all of them have been adapted to some extent to meet the needs of slim-hole, deep-well drilling. Much of this adaptation was achieved through use of better steel and other materials. Other adaptations have resulted from the introduction of new drilling techniques.

For example, many drilling contractors today use the largest possible drill collar for slim-hole drilling in order to realize a greater rate of penetration and drill a straighter hole. This has necessitated the creation of many non-A.P.I. sizes of wash pipe capable of cleaning up jobs that otherwise would have been whipstocked or junked. It has also brought about the introduction of many new types of diamond and carboloy rotary mills especially designed to mill out collapsed casing over cemented tubing, to drill out stuck packers, or mill a fishing neck on a string of stuck drill collars having too large a diameter to catch with an overshot.

Then there are the more specialized tools developed recently—like the magnetic and reverse baskets designed to pick up bit cones and other small objects in the well. A new type of mill is the cone burster that makes possible drilling up a whole bit, cement retainers, or other objects too risky for a regular bit. And finally, there are the many "one-job tools" designed to perform a particular function. These are painstakingly custom-made, and they seldom fail to clean up the job.

Yet for all the increased efficiency of these new tools and techniques, the skill of the operator is still the most important factor in fishing. Without a competent operator, a simple job can become a time-wasting problem and a complex job an impossible one.

What does it take to make a competent operator? Basically, he must be a good well man and a skilled mechanic. He must have the knowledge and the experience to interpret the various conditions that develop as the job progresses. And he must have the ability to visualize, as accurately as possible, what is taking place in the well thousands of feet beneath him.

As for his mechanical ability, the good operator has to know the mechanics of the tools he uses — know which tool to use for the particular job at hand. He has to know not only the mechanics of the tools he has on hand, but also those of all other fishing tools in current use as well as those regarded as obsolete. Often an "obsolete" tool is just the one needed to perfect today's job.

In short, the good fishing-tool operator is an expert craftsman at his trade. His skill, combined with the efficiency of the tools at his command, are indispensable in modern drilling operations.

Author is superintendent of fishing-tool department, Brown Well Service of West Texas, Odessa.

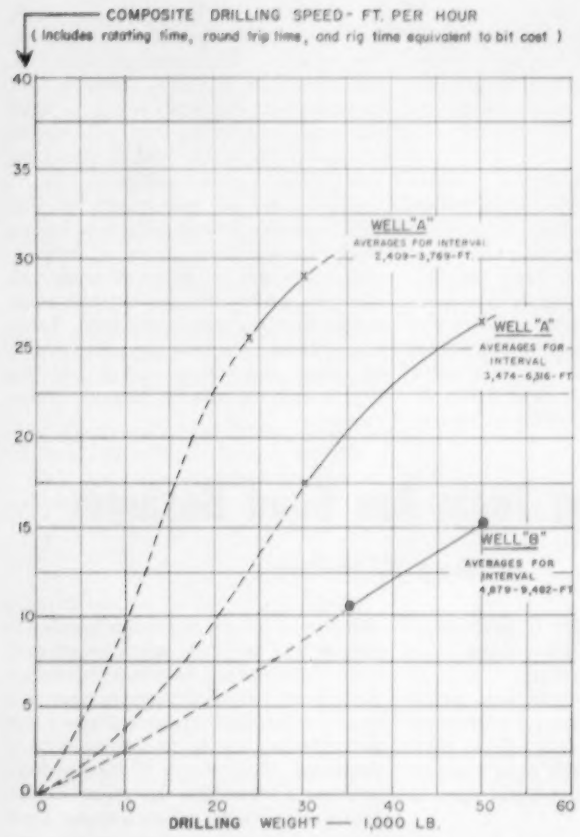


Fig. 1—Effect of drilling weight on bit performance at Ventura. Speed of rotation 300 r.p.m., 10⅝-in. tricone bits used.

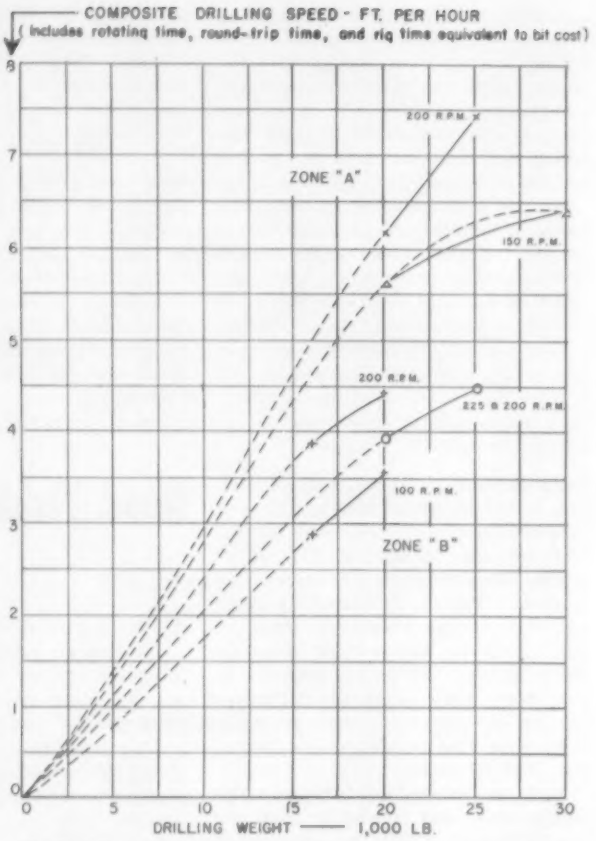

COMPOSITE DRILLING SPEED - FT. PER HOUR
(Includes rotating time, round-trip time, and rig time equivalent to bit cost)
200 R.P.M.
ZONE "A"
150 R.P.M.
200 R.P.M.
225 & 200 R.P.M.
100 R.P.M.
ZONE "B"
DRILLING WEIGHT — 1,000 LB.

Fig. 2—Effect of drilling weight on bit performance at Ventura. Here the tricone bits were 6-in.

Drilling Time Reduced 31 Per Cent

87 days in 1951–60 days in 1954, Ventura experience

by John W. Speer

DRILLING - TECHNIQUE studies conducted by Shell Oil Co. in Ventura field of coastal California have resulted in a pronounced decrease in total drilling time. Wells today are being drilled 31 per cent faster than they were 2 years ago, and still further reductions are anticipated.

The studies were initiated concurrently with the introduction of jet rock bits in the field. They primarily have been concerned with the determination of how the following factors affect drilling rates: (1) weight on bit, (2) speed of rotation, and (3) mud - circulating rates. Drilling-fluid properties, which also affect bit performance to some extent, as yet have not been included as a part of the studies.

Author is with Shell Oil Co., Los Angeles.

In investigating these factors it obviously is necessary to consider their combined effect and, further, the type of formation drilled. It would be expected that some optimum combination of these factors would produce maximum drilling efficiency for a specific formation. The determination of this optimum combination has been the objective of these studies.

That the tests have been generally effective is borne out by the trend of drilling times. In 1951, about 87 days were required to complete an 11,500-ft. well, which is the approximate average depth of Ventura field drilling. During the first quarter of 1954 these wells were being completed in about 60 days, or in about 31 per cent less time.

Not all of the effects of the various factors have been completely defined, nor have optimum results yet been produced. The following findings and discussion, therefore, are to be taken only in the nature of a progress report. It is anticipated that data gained from continued studies may alter them somewhat.

Briefly, the drilling-technique studies show that these factors affect bit performance as follows:

Drilling weight . . . Using 10⅝-in. bits, drilling rate is increased through the increase of drilling weight up to 50,000 lb. Additional increases in drilling rate might be obtained through further increase in drilling weight.

Using 6-in. bits, drilling rate is increased through increases in drilling

Tool Pusher's Reference

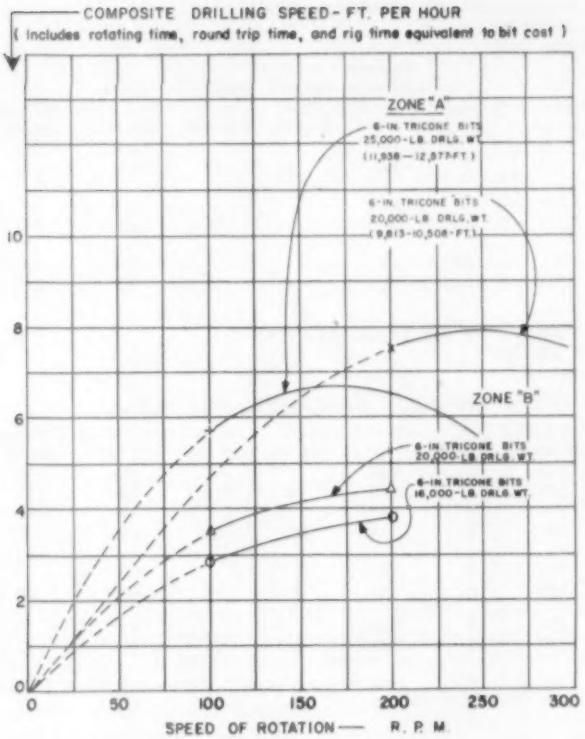


Fig. 3—Effect of speed on rotation on 6-in.-bit performance.

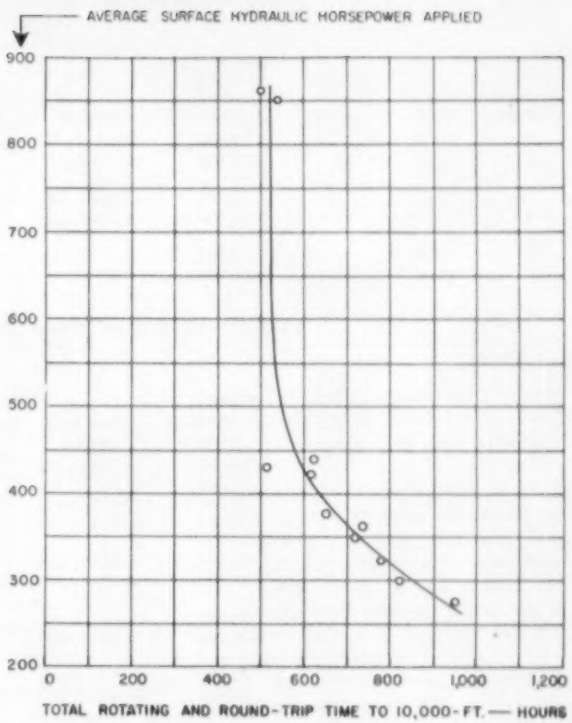


Fig. 4—Relationship between surface hydraulic horsepower applied and drilling time; 4½-in. drill pipe.

weight up to 30,000 lb. Further increases in drilling weight probably will not materially improve drilling rate.

Speed of rotation . . . The few facts obtained using 10⅝-in. bits indicate that within the range of 250 to 350 r.p.m., drilling rate varies directly with speed of rotation when using 20,000 to 30,000-lb. drilling weight.

Using 6-in. bits, drilling rate is increased through increases in speed rotation up to an optimum speed which varies indirectly with the drilling weight used. These optimum rotary speeds are approximately 175 r.p.m. when using 25,000-lb. weight and 225 r.p.m. when using 20,000-lb. weight.

Hydraulic horsepower . . . With present drilling techniques, wherein the maximum drilling weights applied are on the order of 50,000 lb., 600-pump hydraulic horsepower used with 4½-in. drill pipe appears to be sufficient to effect maximum drilling rates. This probably would change, however, with improvements in drilling methods and the application of greater bit weights. Limitations on rotary torque presently restrict the maximum weight that can be used.

An investigation of methods of restricting or controlling well-bore deviation was necessarily carried out as an integral part of the studies. Because these studies are incomplete, they will not be taken up in this article. It has been found, however, that through increase in the size of drill collars and through use of properly placed stabilizers, control of hole deviation is improved. Use of "packed hole" stabilization near the bit has been found to have an adverse effect on deviation.

Tool Pusher's Reference

How Drilling Tests Were Conducted

Ventura field is an elongated anticline approximately 8 miles long and slightly more than 1 mile wide. Formations penetrated consist of interbedded sands and shales, and may be classified soft to medium-hard drilling. Formation dips vary from zero to about 70° from the crest outward to the flanks of the structure.

Drilling rates vary appreciably from well to well, and with depth in individual wells. Drilling data therefore were obtained through controlled drilling tests over large intervals within individual wells. Tests were made by alternately varying test conditions on successive bits. Results then were calculated on the basis of a complete bit run.

Inasmuch as drilling cost is the yardstick by which drilling efficiency is measured, comparisons of test results are made to reflect this item. For this purpose, a unit of measure termed "composite drilling speed" is used. This unit is defined as the **total footage drilled by a bit** divided by the sum of (1) **rotating hours,** (2) **hours required to round-trip the drill string** in order to replace the bit, and (3) **hours rig time equivalent to bit cost.**

"Composite drilling speed," hereafter also referred to as drilling rate, thus is inversely proportional to unit drilling cost. In order to eliminate the effect of hoisting efficiency from drilling performance data, round-trip time was taken from a standard curve developed for the field.

Effect of drilling weight . . . Determination of the effect of drilling weight on drilling efficiency has proved difficult. One reason is the difficulty in isolating effect of weight from the effects of bit hydraulic horsepower and speed of rotation. Likewise, difficulties resulting from hole deviation and use of long drill-collar strings in whipstocked wells have restricted testing operations. As a result, sufficient test data have not been obtained to conclusively define optimum drilling weights, although some indications of optimums have been obtained.

Until recently, little regard was given to rotary speed when testing the

TABLE 1—EFFECT OF DRILLING WEIGHT ON BIT PERFORMANCE
(VENTURA FIELD)
(10⅝-in. Tricone bits)

Well No.	Drilling weight (lb.)	Total test interval	Footage drilled on test	No. bits	Average composite drlg. rate (ft./hr.)	Per cent inc. in drlg. wt.	Per cent inc. in drlg. rate	Approx. rotary speed (r.p.m.)	Footage per bit
A	24,000	2,409-3,474	626	2	25.7			300	313
	30,000	2,799-3,769	733	2	29.0	25	13	300	367
A	30,000	3,474-6,316	1,167	5	17.4			300	233
	50,000	3,769-6,146	1,349	4	26.5	67	52	300	337
B	35,000	5,127-9,482	1,916	12	10.6			300	160
	50,000	4,879-9,331	2,396	11	15.2	43	43	300	218

TABLE 2—EFFECT OF DRILLING WEIGHT ON BIT PERFORMANCE
(VENTURA FIELD)
(6-in. Tricone bits)

Well No.	Drilling weight (lb.)	Total test interval	Footage drilled on test	No. bits	Average composite drlg. rate (ft./hr.)	Per cent inc. in drlg. wt.	Per cent inc. in drlg. rate	Approx. rotary speed (r.p.m.)	Footage per bit
C	16,000	10,414-11,306	224	4	3.86			200	56
	20,000	10,263-11,410	377	6	4.40	25	14	200	63
	16,000	10,482-11,343	173	4	2.89			100	43
	20,000	10,337-11,258	268	5	3.54	25	22	100	54
A	20,000	10,043-11,245	400	8	3.90			225	50
	25,000	10,122-11,367	336	6	4.46	25	14	200	56
D	20,000	9,287-9,730	278	4	6.16			200	70
	25,000	9,380-9,658	243	3	7.39	25	20	200	81
E	20,000	11,321-11,946	366	5	5.60			150	73
	30,000	11,401-12,005	404	5	6.38	50	14	150	81

effect of drilling weights. General practice was to reduce rotary speed as drilling weights were increased, in order to prolong bit life. More recent results indicate that care must be exercised in the reduction of rotary speed to insure that this reduction does not offset the effect of increased weight.

Results of recent tests made to investigate the effect of drilling weight on drilling rate using 10⅝-in. bits are given in Table 1. These tests were made with drilling weights of 24,000 to 50,000 lb. and a rotary speed of approximately 300 r.p.m.

Referring to Table 1, a significant increase in drilling rate resulted from increases in bit weight in each test. It is also interesting to note that footage per bit was increased through increases in drilling weight in each test, although bit life in hours was reduced by some 10 to 20 per cent. Thus, the resulting increase in penetration rate more than offset the reduction in bit life caused by the increase in bit loading.

Shown graphically in Fig. 1, these data further indicate that additional improvements in drilling rate might result from further increases of weight, particularly at the greater depths where the formations are presumably harder. Considering test results from shallow depth intervals, it appears that a definite weight limit is in sight, say, near 50,000 to 60,000 lb. For the deeper intervals, a limit is not so clearly indicated. It would appear, however, that drilling weights in excess of 60,000 lb. might prove to be optimum.

There were no indications of balling up during any of these tests. Therefore it is assumed that circulating rates did not affect the results.

Results of drilling-weight tests made in 6-in. holes drilled below 7-in. casing, using oil-base mud, are given in Table 2. As shown, drilling weights of 16,000 to 30,000 lb. were used with various speeds of rotation ranging from 100 to 225 r.p.m. An increase in drilling rate resulted from increases in weight on bit in each test. Footage per bit was also increased by the higher weight in each test.

Referring to Fig. 2, wherein these data are shown graphically, it would appear that the effect of drilling weight begins to decrease at about 20,000 lb., and that 30,000 to 35,000 lb. might prove to be the optimum weight for the drilling conditions experienced in these zones.

Effect of rotating speed . . . Test data relative to the effect of speed of rotation on drilling rate using 10⅝-in. bits have been difficult to obtain because of the widely varying torque conditions experienced in the field. The tests also were hindered by lack of the rotary horsepower necessary to maintain test conditions using heavy drilling weights. As a result, test data accumulated with 10⅝-in. bits are rather scant.

Obviously, some measure of the energy of the circulating fluid applied to the bottom of the hole would be a better medium for comparison than pump horsepower. Likewise, a relationship between bit hydraulic horsepower and drilling rate for various well depths would be enlightening. However, because of the varying drilling condition throughout the field and within individual wells, these relationships have been difficult to develop. Therefore, pump horsepower and average drilling time were used for expediency.

In concluding, the author again wishes to point out that not all of the effects of the various factors have been completely defined and, consequently,

TABLE 3—EFFECT OF SPEED OF ROTATION ON BIT PERFORMANCE
(VENTURA FIELD)
(10⅝-in. Tricone bits)

Well No.	Speed of rotation (r.p.m.)	Total test interval	Footage drilled on test	No. bits	Average composite drlg. rate (ft./hr.)	Per cent increase in rotary speed	Per cent increase in drlg. rate	Footage per bit
F	250	3,728-5,767	940	4	17.2			235
	350	3,291-5,556	1,526	4	27.3	40	59	382

TABLE 4—EFFECT OF SPEED OF ROTATION ON BIT PERFORMANCE (VENTURA FIELD)
(6-in. Tricone bits)

Well No.	Speed of rotation (r.p.m.)	Total test interval	Footage drilled on test	No. bits	Average composite drlg. rate (ft./hr.)	Per cent increase in rotary speed	Per cent inc. in drlg. rate	Drlg. wt. (lb.)	Footage per bit
C	100	10,482-11,343	173	4	2.89			16,000	43
	200	10,414-11,306	224	4	3.86	100	34	16,000	56
	100	10,337-11,258	268	5	3.54			20,000	54
	200	10,263-11,410	377	6	4.40	100	24	20,000	63
G	100	11,938-12,317	284	3	5.77			25,000	95
	250	12,018-12,377	218	3	5.42	150	—6	25,000	73
H	200	9,813-10,451	373	4	7.55			20,000	93
	300	9,897-10,508	322	4	7.51	50	0	20,000	81

TABLE 5—JET VELOCITIES AND CIRCULATING RATES

Depth	Pump pressure (psi.)	Circulating rate (g.p.m.)	Jet velocity (ft./sec.)	Annular rising velocity (ft./min.)	Bit hydraulic (hp.)
1,000	1,475	690	298	182	350
5,000	1,725	590	255	155	220
10,000	2,000	515	222	137	147

that this is a progress report. That the studies have been beneficial is shown by the 31 per cent drop in total drilling time for Ventura wells. Some progress has been made toward determining the optimum combination of the various factors studied. But as more is learned about drilling techniques, opinions regarding optimum combinations probably will change slightly.

Table 3 shows the results of a single test for rotary speeds of 250 to 350 r.p.m. used in conjunction with drilling weights varying from 20,000 to 30,000 lb. These data show that drilling rate is directly proportional to speed of rotation within the range of 250 to 350 r.p.m. when used with drilling weights of 20,000 to 30,000 lb. It would also appear that the optimum rotary speed was not approached during this test.

Results of rotary-speed tests made using 6-in. bits are given in Table 4. These tests were made with rotary speeds varying from 100 to 300 r.p.m. and drilling weights varying from 16,000 to 25,000 lb.

These data show that, as would be expected, drilling rate varies directly with speed of rotation up to some optimum, and that further increases in speed above this optimum causes a reduction in drilling rate. Also, the maximum rotary speed that can be used advantageously varies with the drilling weight used.

Referring to Fig. 3, wherein these data are shown graphically, results obtained from tests in Zone A indicate that approximately 225 r.p.m. is optimum when used with 20,000-lb. weight; whereas, about 175 r.p.m. would appear to be optimum when using 25,000 lb. Results obtained in Zone B appear to corroborate those from Zone A.

Effect of hydraulic power . . . Effect of applied hydraulic horsepower on drilling rate is somewhat indirect inasmuch as its function is to remove cuttings rather than produce them. Its primary contributions to drilling efficiency are (1) removal of chips and loose formation to prevent recutting, and (2) cleaning of the cutter teeth to prevent balling up. Thus, proper circulating fluid action permits greater drilling weights and rotary speeds to be used to effect increased penetration rates.

It is generally accepted that these functions are best accomplished with a particular combination of jet velocity and circulating rate. Although the individual effects of each of these factors have not been defined in Ventura field, a general relationship between applied pump horsepower and average drilling time to various depths has been developed.

One of these is shown in Fig. 4 where average pump horsepower and average drilling time to 10,000 ft. are plotted. Drilling time here includes rotating time plus round-trip time to change bits, with the round-trip time taken from a standard curve. All results were obtained using 4½-in. drill pipe, or were adjusted to the equivalent of 4½-in. drill-pipe usage.

Referring to Fig. 4, it is seen that with the use of 4½-in. drill pipe, drilling performance may be improved, or drilling time reduced, by increases in hydraulic horsepower up to about 600. Above 600 hydraulic horsepower, little additional improvement is indicated. Using 5-in. drill pipe, about 475 hydraulic horsepower results in performance equivalent to that obtained with 4½-in. drill pipe and 600 hydraulic horsepower.

According to these results, there is a maximum circulating rate and jet velocity that can be utilized in drilling a hole. In considering these particular data, however, it is likely that this relationship will change when all of the other factors that affect bit performance are better defined.

The jet velocities and circulating rates normally used throughout the Ventura field with 4½-in. drill pipe and 600 hydraulic horsepower available are shown in Table 5.

What Do You Know About Drilling Contractors?

How big is a big contractor? For a United States rotary-drilling contractor to be bigger than the average, he has to own only three rigs. To be bigger than 90 per cent of all contractors he has to own only seven rigs. It stacks up this way:

Number of contractors who own	
only 1 rig	389
2 rigs	321
3 rigs	184
4 rigs	96
5 to 9 rigs	160
10 to 14 rigs	35
15 to 19 rigs	7
20 to 29 rigs	5
30 to 40 rigs	4
More than 40 rigs	2
Total U. S. rotary-drilling contractors	1,203

Do big contractors own most of the rigs? According to the Journal's 1954 census, of the 3,829 rotary drilling rigs owned by United States contractors, one-half are owned by contractors having four or fewer rigs. Three-fourths of all of the rigs are owned by contractors having eight or fewer rigs.

Centrifuge may point way to

Reduced Drilling Costs on Deep Wells

Most drilling men now agree that low-solids mud can reduce drilling time and improve bit performance. With competition what it is, the contractor can no longer fail to take advantage of any method at his disposal to drill faster. The centrifuge described here promises to be a relatively inexpensive way to keep a weighted low-solids mud and to help the contractor make money on the hole.

by Ed McGhee
Drilling-Production Editor

Fig. 1—The Phillips Petroleum Co. Houston "X" in Chocolate Bayou field of Brazoria County, Texas. A centrifuge was used on this well to maintain a low-solids mud.

LATEST tests conducted by Phillips Petroleum Co. on the Gulf Coast indicate that use of a centrifuge on weighted drilling muds may well be a part of the answer to reducing deep-well costs. The centrifuge is being employed principally to remove troublesome drilled solids and to reclaim expensive weighting materials. It can also be used to conserve the liquid phase of a mud, or to change over from a lime-base mud to a low-solids mud.

During the past few years, considerable savings in drilling costs have been obtained by the use of muds from which have been removed the drilled light-clay solids. These muds, called "low-solid drilling fluids," have in many cases made possible savings up to 25 per cent of drilling days and 20 per cent of total bits. Prior to the introduction of the centrifuge, low solids were maintained by water dilution, which is often an expensive method.

On two recent wells in Chocolate Bayou field, of Brazoria County, Texas, the operator was able to reduce mud maintenance costs from $270 per day on the first to $66 per day on the second. The first well drilled with a 17.5-lb. lime-base mud, but the second used a 17.5-lb. low-solids mud maintained by a centrifuge. Moreover, the wells were offsets, drilled by the same rig, and neither encountered any special mud problems.

On a fishing job . . . At another Chocolate Bayou well that had a prolonged fishing job, a centrifuge was used to condition the mud for the resumption of drilling when the fish was recovered. The top of the fish was below 10,000 ft. and the hole was open below 7,000 ft. Fishing continued for more than 4 weeks, and it was often necessary to leave the fishing string on bottom without rotation for as long as 12 hours. The tool pusher on the rig reported that the pipe showed no tendency to stick during these intervals, and he gave credit to the low-solids mud prepared by the centrifuge.

Several attempts at mechanically treating drilling muds have been made in the past, with varying degrees of success. The present Gulf Coast applications by Phillips are, however, the first reported applications of a centrifuge to show sustained trouble-free service. With information now available, the rig crew can be trained to properly operate and maintain the machines.

Why a centrifuge? . . . The current

Fig. 2—Centrifuge in place over steel mud tanks. Mud in tanks weigh 18 lb. per gal., has 6 to 8 per cent oil, but viscosity is only 51 to 52.

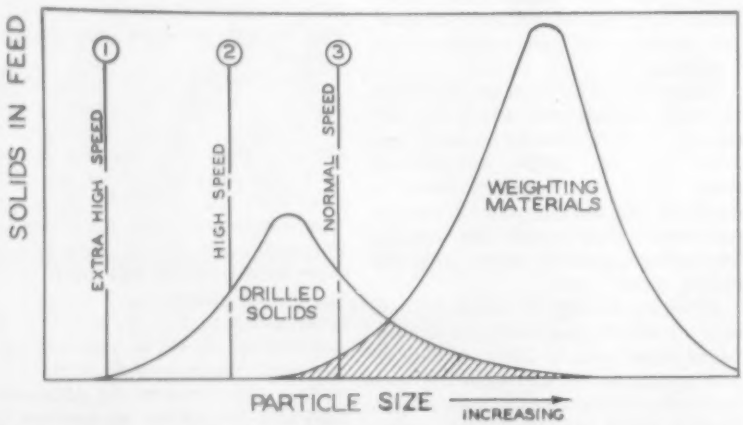


Fig. 3—This chart shows the effect of the operating speed of the centrifuge on the separation of drilled solids and barites. All solids to the right of the dotted lines return to the circulatory system.

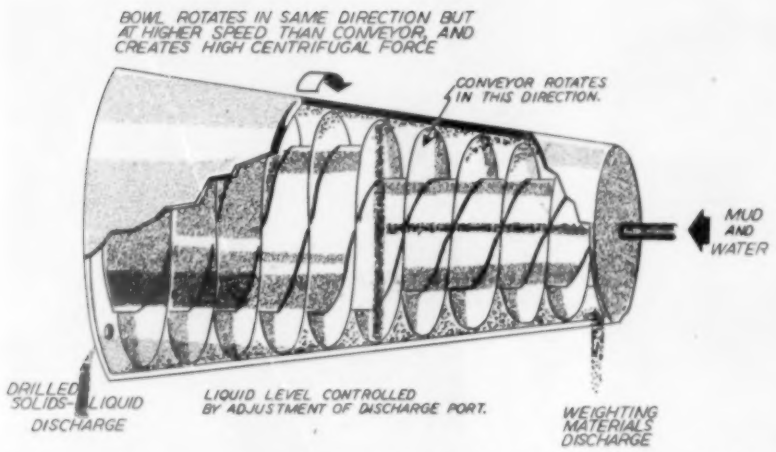

BOWL ROTATES IN SAME DIRECTION BUT AT HIGHER SPEED THAN CONVEYOR, AND CREATES HIGH CENTRIFUGAL FORCE
CONVEYOR ROTATES IN THIS DIRECTION.
MUD AND WATER
DRILLED SOLIDS-LIQUID DISCHARGE
LIQUID LEVEL CONTROLLED BY ADJUSTMENT OF DISCHARGE PORT.
WEIGHTING MATERIALS DISCHARGE

Fig. 4—Schematic representation of the decanting centrifuge. There is a case around the entire unit shown here.

interest in mechanical treatment stems from a growing feeling in the industry that chemical treatment has about run its course. Further improvements are generally expected to be mostly in the nature of refinements and substitutions, rather than any drastically new and different developments. Initial attempts at mechanical treatment were made before chemical treatment had reached its present efficiency and widespread acceptance. Therefore, periodic advances in chemical treatment have very often shoved aside any serious work on mechanical treatment. With the new developments in chemical treatment coming less frequently now, mud men are beginning to turn back to other methods of improving mud performance.

The purpose in most chemical treatment is to make the mud tolerate more drilled solids without losing desired qualities of viscosity, water loss, and filter cake. Therefore, a mechanical method to remove the drilled solids immediately effects a saving in chemicals.

Watering back is costly . . . It is still the practice in most areas to "water back" a weighted mud when it is desirable to reduce the drilled-solids content. Part of the mud in the active system must be jetted away to the reserve pits in order to make room for the water being added. The loss is double. First, the mud jetted to the reserve pits probably cost $15 per barrel including maintenance to condition with chemicals and weighting materials. All that is completely lost. Secondly, more chemicals and weighting material must be added to the watered-down mud to bring it back to original weight and to the desired properties. That is, of course, an actual out-of-pocket expenditure. Needless to say, it wouldn't require much saving in weighting material each day to pay for the approximately $12,000 investment in an installed centrifuge.

How the Separation Works

Fortunately, there is a fundamental physical difference between the drilled solids suspended in the mud and the weighting material deliberately added. Density of the drilled solids is in the range of 2.5 to 2.7, while the density of barites is around 4.1 to 4.3. This means that a centrifuge, properly operated, can separate the drilled solids from the weighting material much the same way that cream is separated from milk. Fig. 3 shows how the particles of barite and clay compare and how the degree of separation of drilled solids can be controlled by varying the speed of the centrifuge.

As may be seen in the figure, some of the drilled solids will be carried back to the circulatory system; but enough of the clay will be thrown out to satisfy all practical requirements. Then too, some of the weighting material will be lost in the discarded material, but only a small fraction of the amount that would be lost in watering back.

Has two elements . . . The machine consists primarily of two revolving elements inside the outside covering. The innermost element is a helical screw conveyor that revolves at a relatively slow speed. The other element is a high-speed bowl that revolves around, and in the same direction as, the screw. The feed into the machine is mud diluted with water. This dilution is done by pumping water into the mud pipe immediately before the combined fluid enters the centrifuge bowl. A schematic representation of the mechine is shown in Fig. 4.

As the bowl revolves at high speed, the solids and weighting material are thrown outward by the centrifugal force. The barites, being heavier, are in the outermost layer, and are conveyed by the screw to one end of the machine where they, with a little fluid, are discharged as a sludge back into the circulatory system. The drilled solids and remainder of the liquid are discharged from the other end and are discarded.

Probably the most convenient place for the centrifuge is a skid mounting over the steel mud tanks. With this arrangement, a small pump for the mud can take positive suction on the tanks to feed the machine. Then both portions of the machine's discharge can gravity out. The sludge containing the barites falls directly into the pit, and the liquid containing the drilled solids gravites to disposal. Fig. 5 shows how the machine is hooked up.

The amount of mud that can be processed by a given centrifuge is limited by the amount of solids in the feed. There are machines presently on the market that have recovered as much as 110 lb. of solids (barites plus small amounts of clay) per minute.

How to use the machine . . . The ideal application of the centrifuge is to have it available on the well all of the time from spud in to final completion. On the upper part of the hole, the machine is used as a desander. In other words, the liquid phase is saved and all solids discarded. That is easily arranged by adjusting the r.p.m. of the machine. On one well, about 1,000 bbl. of mud per day was processed by a centrifuge in desanding service.

The ability of the machine to retain the liquid out of the mud is particularly valuable in drilling thick salt sections where it is undesirable to add fresh water. If the mud is allowed to become saturated, or if enough salt is added to make it saturated, any further hole enlargement can be prevented by preserving the liquid phase of the mud intact. The centrifuge will remove any drilled solids, and preclude the necessity of adding appreciable quantities of fresh water.

As weighting material becomes necessary, the centrifuge can revert from desanding service to normal operation of removing drilled solids and retaining barites.

On lime-base muds . . . Because the high temperatures at great depths can cause the gelation of lime-base muds,

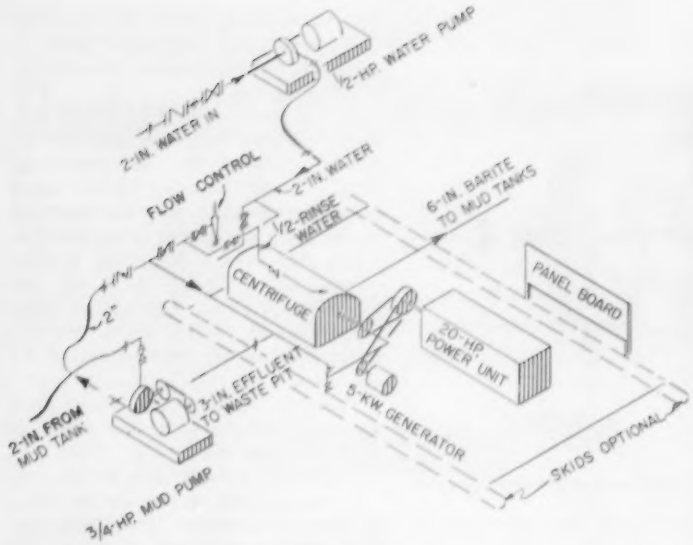


Fig. 5—Layout of centrifuge with fittings.

Fig. 6—Torque gage shows operator when he is feeding maximum possible amount of mud to machine.

it is not good practice to leave them in the tubing-casing annulus when final completion is made. Therefore, if a lime-base mud is used in drilling, it is usually discarded before a production packer is set. However, if the mud is centrifuged, it can be converted from a lime-base to a low-solids mud within a short time. Consequently, if the centrifuge is applied to the mud during the waiting time on cement, a good "packer mud" is available with no expense other than the operation of the centrifuge.

In most wells, the centrifuge will usually be used progressively less as depth increases. The very deep shales are more dense than the shallower ones and do not suspend as many solids in the mud.

Some operators have suggested mounting a centrifuge on a trailer so that the machine might be used on several rigs in the same general locality. Certainly, it would be easier to justify the investment in the machine if it could service several wells simultaneously. Other operators consider that satisfactory service can come only from installing one machine per rig and, thereby, being certain that it is available when needed.

For drilling barges . . . Centrifuges have been mounted by Phillips in drilling barges operating in the Gulf of Mexico. A saving should arise from these applications because of the lessened need for fresh water, which would otherwise have to be barged in at considerable expense. One suggested method is to save the effluent liquid containing the drilled solids. Then, when the centrifuge is idle from normal operation, it can be run as a desander and the liquid recovered for further use in the circulatory system.

On holes where an intermediate string of casing is set, the reduction of hole size usually means a smaller required mud volume. It is then possible to concentrate 1,000 to 1,200 bbl. of a 15-lb. mud to about 700 bbl. of an 18-lb. mud by centrifuging the mud while waiting on cement.

How Mud Properties are Affected

The relatively low viscosity of these heavy drilling muds has, of course, several advantages. In high-pressure areas, it minimizes the swabbing effect of pulling the pipe. Likewise, it lessens the danger of man-made lost circulation resulting from piston effect of running pipe. Moreover, the low viscosity permits sand and other drilled cuttings to settle out more readily in the pit.

On a rig having a slush pump incapable of achieving proper annular velocities, it may be necessary to carry an increased viscosity to properly remove cuttings. However, it is usually an easy matter to increase viscosity. On the rig having the usual pump horsepower, the relatively low viscosity is beneficial by reducing the frictional loss down the drill pipe, and maintaining a greater portion of the pressure drop across the jet-bit nozzles.

Operating the Centrifuge

According to the men who have done a large part of the early work on the centrifuge, almost the only way to seriously harm it in usual operation is to shut it down without first flushing out the mud. The solids in the machine are not thrown out before the machine stops rotation, and will subsequently settle to the bottom of the bowl. Then, when the machine is next started, the settlings cause an unbalance that could ruin any high-speed machine. Consequently, the first step in shutting down the machine is to stop the mud flow into it. After a short time the machine itself may be cut off. Then while the bowl is slowing down, the water may be stopped.

Starting the centrifuge into operation is routine and follows these steps. First, the machine is set into rotation. Next, the diluting water is commenced, and then the mud is introduced gradually, the final rate depending on the weight of solids in the mud. There is a torque gage on the machine (see Fig. 6) that shows the operator when he is introducing the maximum volume of mud. This torque gage can also activate a shutdown switch to guard against excessive over load.

Wear of bearings and other parts has not been excessive. The presently operating machines are driven by gasoline engines in the 15-hp. range. It may be that 25 hp. will prove to be the best power, particularly for the larger machines now being introduced.

Acknowledgment

The author wishes to thank A. V. "Van" Williams, of Drilling Specialties Co., Houston, for furnishing much of the information used in this article.

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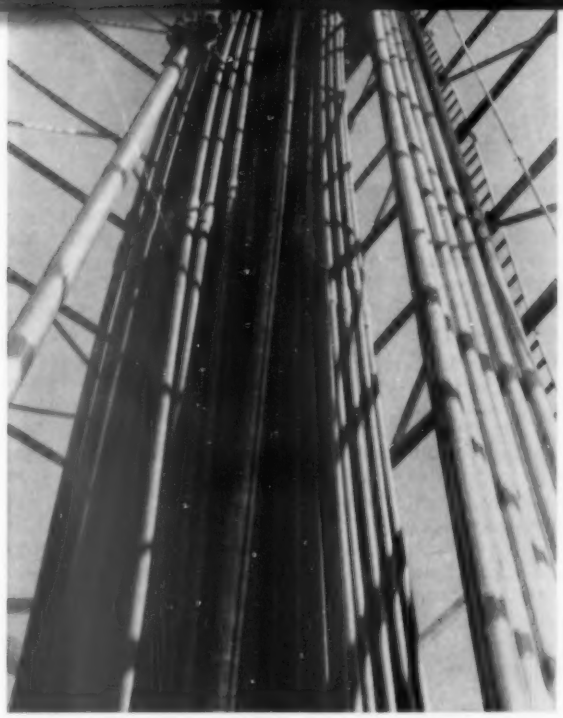

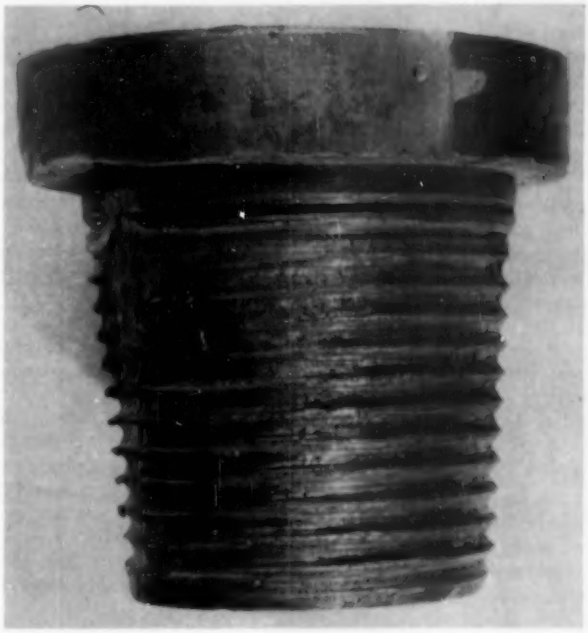

Fig. 1—(Left) Coming out of the hole with the last stand of drill collars—three 7-in. o.d. collars run below twenty 6¼-in. o.d. collars. This 65,000-lb. drill-collar assembly was used by A. W. Thompson, Inc., Rig 1 while drilling 7⅞-in. hole in Headlee field, Ector County, Texas. When this picture was made, hole depth was below 13,000 ft. Fig. 2—(Right) A leaking pin shoulder resulted in this condition.

There's a Big Investment in Those Drill Collars . . . Here's how to protect it

by H. M. Rollins

MUCH can be done by the drilling contractor through training and supervision to protect his investment in drill collars. A little thought, care, and discipline with regard to operating procedures can save thousands of dollars in rig time, and in equipment. Without those things, failures similar to these can occur:

1. Recently a string of new drill collars, manufactured by a major supplier, was put in service on a drilling rig operated by a progressive contracting company. After approximately 1,000 ft. of drilling, three drill collars had been laid down because of severely galled threads. Before 1,300 ft. depth was reached, a total of seven collars had been laid down for this cause.

2. Within a few days, a similar circumstance existed on a different rig a few miles away, with a different manufacturer and a different contractor involved.

3. In a third instance a drill-collar joint failure occurred in a string of new collars, after only 4,000 ft. of hole was made with these collars. The broken-off box still had the manufacturer's paint on the o.d. of the collar, which at this point was a reduced-diameter fishing neck.

Materials not to blame . . . In each of these cases, the immediate reaction of the rig personnel was to blame the failures on poor material. In none of these cases was the material outside of usual specifications, and in each case, when poor operating practices ceased or poor design was corrected, the troubles stopped.

These instances in which large investments in drill collars and rig time are jeopardized are unnecessary; that they are not unusual is shameful.

No reputable manufacturer of oilfield equipment, in particular of drill collars, is going to ship out a product bearing his name and reputation, which is not of the usual quality generally accepted by the industry. All manufacturers of drill collars maintain inspection departments, usually independent of the manufacturing department and responsible only to management, to insure that their products are of good material and the joints are within A.P.I. standards.

You can be assured that when a new drill collar leaves the plant, it is serviceable. What happens to it in handling and in operation can soon render this large capital investment worthless. What is more important, the loss of the use of the drill collars may hamper drilling progress to an extent that can cost the contractor much more than the collars.

How drill collars evolved . . . Before going into some of the ways in which drill collars are damaged in service, let's see how we happen to be using drill collars as a drilling tool. When rotary drilling first began, the drill collar was that short pipe coupling which joined

"Excessive makeup can also damage joints, especially small-sized ones"

the bit shank to the first joint of threaded and coupled line pipe which was used as drill pipe.

As drilling practices developed and rotary-tool joints came into use, the drill collar grew to a sub 4 ft. long designed so as to accommodate the bit lubricator. In order to get a stiffer assembly above the bit, and more weight at the bit, a few joints of hydraulic pipe were used just above the bit. In the 1920's the first 20-ft.-long drill collars made their appearance. Early attempts to operate "tandem strings" of drill collars invariably resulted in excessive joint failure.

As late as 1946, usual drilling practice in "hard rock" country was to use no more than five or six drill collars. Moreover, in Illinois, Kansas, parts of Oklahoma, North Texas, and the Gulf Coast, this is still standard practice. In these areas, drill-collar problems are not acute; and other than occasional leaking joints, or "hard to break" joints, joint failure is rare.

Long collar strings start . . . In 1946 long strings of drill collars came into use in the Permian basin area as it was demonstrated that heavy weight (5,000 lb. per in. of bit diameter) was essential to penetration of hard formations in that area. Strings of fifteen to twenty 6¼-in. o.d. collars in 8¾-in. hole became the usual assembly. Adoption of this practice had two almost immediate results:

1. A reduction in drill-pipe failures, as the pipe was no longer used for weight and was held in tension by excess drill-collar weight.

2. An increase in drill-collar-joint failures, particularly of the pin end of the joint.

Elimination of these wholesale drill-collar-pin failures required a reduction in rotary speed from the usual 90 to 150 r.p.m. down into the range of 50 to 80 r.p.m., and more careful attention to handling procedure, makeup troque, and lubricant quality.

Further, more attention was given to drill-collar-joint selection and design than had been required before.

As a direct result of this concentrated attention to drill-collar failures, the H-90 joint was developed, and cold working of the thread roots to increase fatigue strength and chemical treatment of new joints to resist galling were adopted.

These design and operational improvements have been widely accepted and together with field inspection service now available have minimized drill-collar service failures in the Permian basin area. Many service failures are averted by periodic magnetic inspection of the drill-collar joints, and by rethreading those joints which are indicated by the inspection to be cracked or damaged.

Bit weights go higher . . . In the last year, a new extra-heavy weight program has become popular, with weights of 7,000-lb. per in. of bit diameter being frequently used. To supply this weight, many operators are using oversize collars, that is 8-in. collars in 8¾-in. hole, or 7-in. collars in 7⅞-in. hole. More commonly, 7-in.-o.d. collars are used in 8¾-in. hole instead of the 6¼-in.-o.d. collars popular just a year or two ago.

Some drilling-rig operators, unable or unwilling to use bigger collars to get this extra weight, are forced to one of three detrimental practices in order to compete:

1. Use of 25 or more small collars to get the desired weight.

2. Use of pipe in compression to get the desired weight.

3. Use of high rotary speed.

Frequently all of these are used in combination. The result has been a considerable increase in drill-pipe failures and in drill-collar-joint failures in the last few months.

Now that there is an increasing amount of drill-collar trouble in the Permian basin area (and in other areas, too, as heavy weight programs are being adopted) it is to the advantage of the drilling contractor to look to every possible means to minimize this trouble on his rigs. Here are some of the things to check on:

Operating Practices

Rotary speed . . . One of the most important factors, speed of the rotary, is the easiest to specify and the hardest to control! Most rigs, due to transmission systems, have three speed ranges for rotary speed. By throttle control, it is practical to vary speed in each range by 10 to 20 r.p.m. Thus by specifying the gear in which the driller is to operate his rotary drive, you can specify within 10 to 20 r.p.m. of the desired speed. Keeping the driller from speeding up the rotary is a matter of discipline, and is apparently difficult to accomplish.

Remember that new drill collars, properly made up, can be caused to leak, and then to gall by use of excessive rotary speed. In the first instance mentioned in the introduction to this discussion, a string of 20 new 7-in. drill collars were damaged in a short time by 170-r.p.m. operation.

Makeup control . . . This is the second most important factor in operation of the drill collars. Insufficient makeup will result in leaking joints, galled threads, and eventually in cracked pins or boxes.

In this regard, remember that the threads of a tool joint can not seal; only the shoulder can seal. In making up, the shoulders must be pulled together so tightly that they will not separate as the collars bend and rotate in the hole. If the shoulders do open up, drilling mud will enter between the shoulders and then be squirted out as the shoulders close, washing out all of the lubricant from the shoulders and lapping the shoulder surface.

Characteristically, a loose joint will rock about one or two places with a result that high spots are left which are bright (and usually galled) on breakout while the lapped area is a dull dark gray. On subsequent makeup, such a shoulder cannot seal, and fluid will wash the lubricant from the threads, causing galled threads and hard-to-break joints. This was the trouble on the second rig mentioned in the introductory paragraph.

Excessive makeup bad, too . . . Excessive makeup can also damage joints, particularly small-size joints. The usual damage is in stretched or broken pins, and occasionally in swelled boxes, with resultant conical-shaped shoulders. It should be remembered that a tool joint is an efficient screw jack, and when made up, this jack is trying to pull off the pin at the shoulder and trying to "squash out" the box at the shoulders. If enough force is applied to the tong handle, something has to give!

The principal difficulty is that, usually, no one knows how much force is applied at the end of the tong handle,

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and this is the only practical way to know if the joint is made up right. Several types of measuring devices are available—the Martin-Decker hydraulic gage unit and Foster spring-type unit are in widespread use. In the Permian basin area, the Drilco Torquemaster is frequently seen. All of these tools are mechanical devices and can and do fail to function properly after continued rig use.

An improperly calibrated line-pull device is worse than none at all. Arrangements should be made to check these units regularly (about every 30 days) and at any time if joint trouble occurs on the rig. Checking can be done very simply at the rig by placing in the line any of the above measuring tools—or a tool similar to the Dillon Dynamometer which is an inexpensive, light but sturdy line-pull checking gage.

Is cathead pulling? . . . While the subject of checking line pull is being discussed, it is suggested that the line-pull capacity of the cathead used to make up tool joints or drill collars, be watched. It should be the first thing checked when joint trouble is encountered. Repeatedly it is found that joint troubles are caused because the catheads on the rig were not pulling as they should.

Drillers often claim that the cathead will pull hard enough to "rattle every bolt in the derrick"; and yet on checking, it is found that the pull is less than 3,000 lb. No one can tell, just by looking, how much pull is on a line. Certainly, no driller would judge his weight on the bit by looking at the dead line, or by the feel of his brake. It makes just as much sense to say he can tell how hard he is pulling with a friction cathead by the feel or by looking at the line. Some kind of measured check is needed, and it should be made frequently enough to insure the cathead is in good adjustment.

Smooth pull does the job . . . One more point about makeup—the driller who jerks the tongs with his cathead may rattle lots of iron—but he may not be making up his joints properly. A smooth, steady pull will get the most available pull from the cathead, and will make the joint up tighter. You can prove this to your driller easily by making a vertical mark across the shoulder of a joint that has been made up by jerking, breaking out the joint, and then making it up by a steady pull. Almost without exception, the joint will make up farther with the steady pull.

It is a situation similar to pulling a truck with a small chain. A jerky start will break the chain, but a smooth even pull with the same chain will move the truck. A stand of drill collars is as heavy as a truck and just as hard to start moving.

Because friction catheads are inconsistent in their pull, and because a smooth, steady pull is hard to attain with one, we recommend the use of a **rope** on a cathead for making up of drill collars. A crew trained in the amount of pull required by using a line-pull gage will soon be getting the pull required at the cathead without need of a gage.

While training the crew, demonstrate to them that an extra wrap on the cathead greatly increases the pull, and eliminates any need to jerk or strain on the line.

Snatch block on big collar . . . Because an 1⅛-in. rope can be expected to break at about 6,000 lb. pull, it is desirable to use a snatch-block system on 7-in.-o.d. collars and it is essential on 8-in. or larger collars.

The various manufacturers of drill collars have available their recommended makeup torque for various collar sizes and can furnish this information through their field men. It is important, however, to be sure of your drill-collar o.d. and pin i.d. as well as your joint size, as all of these factors affect the makeup torque required.

Handling Procedure

Much has been written about care of tool joints and drill collar joints—and it all continues to hold true. However, it is still not uncommon to see men catching chains between shoulders while spinning up collars. Moreover, pin threads and box shoulders are still damaged when collars are laid down or picked up without thread protectors.

Lift subs or plugs are thrown down without care, damaging threads and shoulders — and eventually damaging every collar in the string, since these lifting tools will be screwed into every box. Certainly everyone knows how to care for drill collars and subs—it just seems to be too much trouble to train the new hands to do it right. It can be done if the tool pusher will insist on it!

What to Look for in Material and Design

When purchasing new collars and when rethreading or stubbing old collars, your selection of o.d., joints, and specification of overshot fishing necks, slip grooves or elevator recesses can have much to do with the troubles you have later.

The largest diameter collar which you can operate in a given hole size will be the most economical size for several reasons. It has been definitely shown that bit performance is improved by using large-diameter collars. For a given amount of indicator weight the drilling rate will be greater, and bit wear will be more uniform. Drill-collar o.d. wear will be measurably less, and joint failures fewer because the larger collars cannot bend so much in the hole.

Further, for a given investment in drill collars, more years of service will be received before the collars are worn so small in diameter that they must be discarded. As an example, in 8¾-in. hole it is much more economical to buy new collars of 7-in. o.d. and 2¼-in. bore than to buy 6¼-in. o.d. and 2¼-in. bore collars.

As a matter of practice, a better procedure would be to buy 7-in.-o.d. and 2¾-in.-bore collars. When the collars have worn to 6¼-in. o.d., it is possible to stub the pin end with 2¼-in.-bore stock and change to a smaller-size joint.

Two bore sizes . . . In order to obtain a more efficient hydraulic condition, many collars are being purchased with 2¾-in. bore for 27 ft. from the box end, retaining 3 ft. on the pin end with 2¼-in. bore. Many strings of collars are being reamed out in this manner in field shops. From a hydraulic standpoint, a 600-ft. string of collars of this design would represent 60 ft. of 2¼-in.-bore and 540 ft. of 2¾-in.-bore collars. This is most important in consideration of fluid flow for utilization of jet bits.

Avoid diameter reduction . . . The use of slip grooves, elevator recesses, and overshot necks should be avoided if at all possible. Slip grooves and elevator recesses reduce the diameter at a point near the box end, and as collars become shorter due to rethreading, these reduced diameters will become stress raisers in the box section.

Overshot fishing necks can also cause difficulty because of lack of balance with the drill-collar string. This was the case of the third rig mentioned in the introduction. A string of 7-in. o.d.

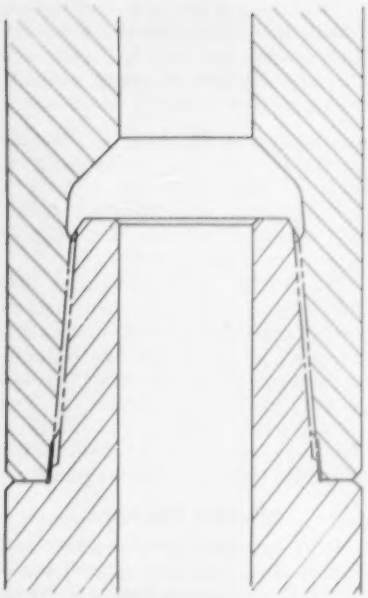


Fig. 3—A stress-relief groove machined at the base of the pin to reduce stress concentration at this critical point.

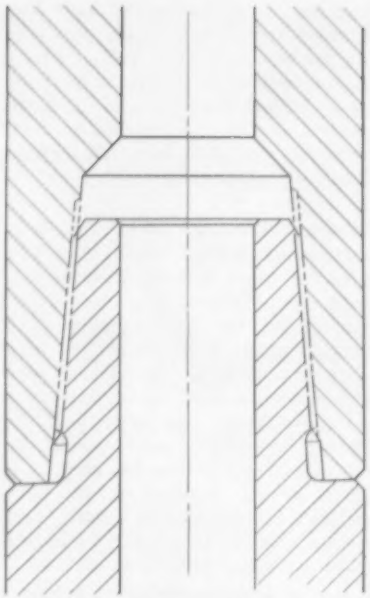


Fig. 4—A stress-relief groove in the bottom of the box removes unengaged threads and reduces stress concentration.

collars was manufactured with 6¼-in. o.d. overshot space, 30 in. long.

Four-and-one-half-inch, extra-hole joints were used; that would have been a well-balanced joint in a full-length 6¼-in.-o.d. drill collar. However, the 7-in.-o.d. body of these collars was nearly twice as stiff as the 6¼-in. section. Therefore, whatever bending this string did, was concentrated in the bottom of the drill-collar box, which was the weakest point of the entire assembly.

Failure in one box occurred in the hole after only 4,000 ft. of drilling with these new collars. Magnetic-particle inspection revealed all other boxes in this string were cracked except the top collar where drill pipe screwed into this box.

To remedy this condition at a minimum loss of material, the collars were rethreaded with 4½-in.-i.f. pins on the 6¼-in.-o.d. end, and 4½-in.-i.f. boxes on the 7-in.-o.d. end. This joint is somewhat better balanced for the 7-in.-o.d. collars. Although the top end of the collars were then 7-in.-o.d., an overshot is available for use in retrieving this size collar from 8¾-in. hole.

Joint should be balanced . . . In selecting the appropriate joint for a drill-collar string, it is essential to maintain a desirable balance of strength between the pin and box members.

One company recommends that the cross-section thickness of the pin at a point ¾-in. from the shoulder be equal to the box cross-section at the end of the pin. Another company recommends that the bending strength of these two critical sections be compared, with the box strength being kept 2.25 to 2.75 greater than the pin section.

Each of these systems is helpful in selecting the proper joint, although consideration of anticipated o.d. wear is also important. In areas where wear is rapid, joints may be selected smaller than is indicated by the above criteria, to allow adequate box strength as the collars wear off.

Stress relief contours . . . Much can be done to improve fatigue characteristics of some joints by incorporating stress-relief contours at the critical points in the joint. Fig. 3 illustrates a stress-relief groove frequently used on pins; Fig. 4 illustrates a similar groove for boxes.

In each case, the stress-relief groove removes threads which are not normally engaged, and although the cross-section of the joint is reduced, the joint stretch is improved by removal of the stress-concentration effect of these sharp thread root notches. It is essential that the undercut be great enough that stress flow will not be concentrated at the first engaged threads. The relief groove surfaces must be smooth and free of tool marks, and a generous radius should be used at each side of the relief groove.

Material

The first fully heat-treated alloy-steel drill collars offered to the industry were made in 1929 from 3140 steel. This steel type remained the usually accepted material for this type of product until World War II when wartime substitutes 8740 and 9440 were used.

Shortly after the war, 4140 and 4142 types of steels were adopted because they offered more uniform heat-treatment characteristics than 3140. These types are still in common usage. Many suppliers can now insure certain hardenability ranges, and a steel which is specified to meet given hardenability will carry the suffix H.

In addition to specifying the chemistry of the steel, and its hardenability, most manufacturers will specify only that their product is within a given hardness range, usually 277 Brinell hardness number to 321 Brinell hardness number.

The manufacturer may check to insure that the impact strength of the steel is not exceptionally low, but few will specify that their product is within any range of values of impact strength as measured by the Izod test. There has not yet been demonstrated any correlation between Izod impact strength and fatigue strength of steel in laboratory tests or carefully controlled field tests.

There is a definite correlation between hardness, tensile strength and fatigue strength. A purchaser who specifies a hardness and a minimum Izod impact strength may do so with reason; but to specify a close minimum-maximum range of Izod impact strength is to place costly and unwarranted restrictions on the supplier.

What about inclusions? . . . The question of nonmetallic inclusions in steel is another item sometimes misunderstood. All steel, by nature of its manufacture, will have precipiated from it as it cools, certain nonmetallic or partially metallic materials which form intergranular inclusions.

In processing a billet to drill-collar stock the steel is forged or rolled to elongate its shape, and these inclusions are usually formed into long thread-like stringers. These stringers are sometimes detected by a machinist as he is machining a drill-collar joint. Unless there is a large concentration of stringers at one critical part of the joint, there is little likelihood that such inclusions will have any effect whatever on the serviceability of the drill collar.

The following is a quotation from the Handbook of the American Society of Metals on this subject:

"Any specimen of steel when ex-

amined closely enough will reveal the presence of particles of material incongruent with the metal lattice and demonstrating either definite nonmetallic or quasimetallic properties. This is not peculiar to steel but is common to most metals and alloys that have been molten . . . These inclusions have been precipitated from the liquor or solid metal as a result of chemical reaction or of solubility changes caused by varying temperature.

"Such inclusions are known as indigenous, natural, or native inclusions and must be considered an integral part of the heterogeneous and complex material known as steel. They are as much a part of steel as seeds are a part of a fruit. Much erroneous thinking has resulted from considering all nonmetallic inclusions as something foreign and apart from steel—something not present if steel has been made properly . . .

"The presence of inclusions in steel is not regarded as good or bad in itself but as a fact . . . A deleterious influence of nonmetallic inclusions on the fatigue endurance properties of steel is probably one of the most widely expected effects; and yet experimental evidence does not support belief in any important detriment to endurance values from indigenous inclusions in their ordinary range of occurence. Throughout a wide range of steels, endurance values for polished bars bear a significantly constant relation to tensile strength . . .

"Fatigue testing is naturally a study of notch propagation, and the reason why indigenous inclusions have so little effect on endurance values is thought to be that they do not produce internal notches in steel. In other words, there is no cavity around an indigenous inclusion; it is wetted by the steel, and there is a bond between steel and inclusion. Thus, the inclusions support some of the stress, even though the modulus of elasticity may be different. There is no apparent reason why an oxide or sulfide inclusion should have any more effect than carbides on endurance.

"It should be emphasized that this discussion concerns only the small, naturally precipitated inclusions."

Premium alloys introduced . . . Recent months have seen the introduction of some premium alloy steels, 41V45 and 4640 compositions, as drill-collar material. Conversely, some experimental strings made from low-cost carbon steels with low hardness have also been placed in service and are performing satisfactorily.

These two developments are indicative of the wide divergence of opinion regarding the importance of materials, and illustrate, perhaps, the much greater importance of handling and operating procedure.

Stubbing prolongs life . . . Many short drill collars are being salvaged for further use by extending them to a full 31-ft. length by stub welding new material to the ends of the collar. This service can now be performed in many field machine shops. Excellent papers regarding the details of these procedures were presented at the A. S. M. E. petroleum conference at Los Angeles in September 1954.

A few things of note regarding design should be mentioned here. The welded structure must be machined to a smooth surface both inside and outside to remove any notches or stress raisers resulting from the weld. The welded area must be stress relieved by a high-temperature draw or normalizing heat treatment.

Hard facing reduces wear . . . There is little value in welding on stubs of greater diameter than the drill collars, as the stubs will very soon be worn to the same diameter as the drill collars unless the stubs are protected by a large area of tungsten carbide hard facing material.

Hard facing may also be applied to drill collars which have a straight outside surface in order to retard the rate of wear. This material is usually applied to a 10-in.-wide band 20 to 30-in. from the pin shoulder. The area adjacent to the joint is then protected from wear and the drill collar life is extended.

Inspection, good insurance . . . It can be demonstrated that where occasional fishing jobs result from drill-collar-joint failure, it is economical to periodically inspect the drill-collar joints for fatigue cracks by the magnetic-particle method. One widespread inspection method is the Magnaflux Corp. Magnaglo procedure, in which a fluorescent magnetic particle suspended in kerosine is used. Ultraviolet light illuminates these particles for rapid interpretation, and improved visibility.

Inspection companies throughout the West Texas-New Mexico area provide this service at the rig, and frequently inspect drill-collar joints at the rotary table on a trip, although the usual procedure is to inspect the collars on the rack after use of the collars on a well.

In a periodic inspection system, damaged or cracked joints are the only ones rethreaded, and good joints continue to serve until inspection indicates they require work. This procedure sometimes results in greater trucking expense than running the collars until enough failures indicate the entire string should be shopped; but, the inspection procedure largely eliminates drill-collar fishing jobs and saves much on drill-collar material.

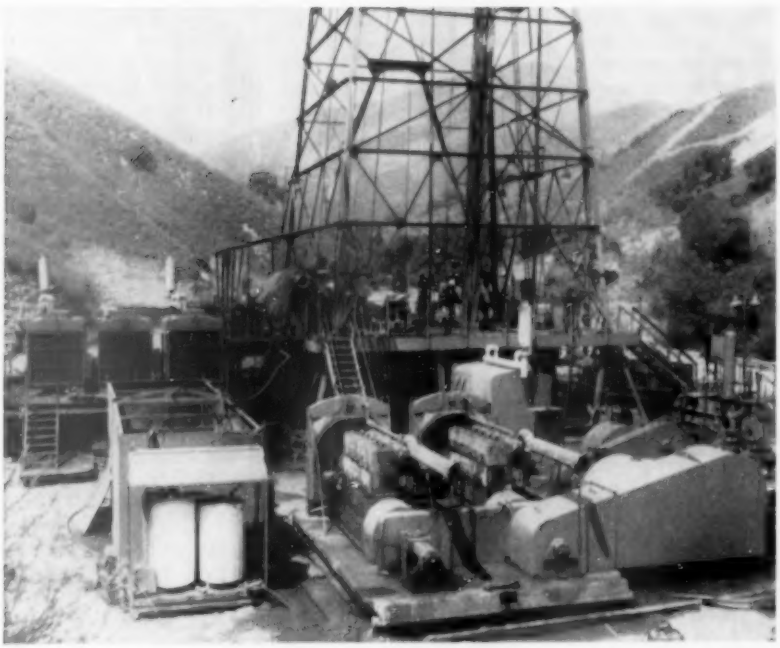
Tool Pusher's Reference

On the beach at Huntington Beach, Signal Oil & Gas Co. has two rigs at work slanting wells from this upland drill site to an offshore lease which begins 1 mile from shore and extends 1 mile farther out.

They Come Big in California

Dunlap & Graham, Inc., rig at work in the bean fields near Oxnard. Drilling for Standard Oil Co. of California, objective was the 9,000-ft. lower Sespe pool discovered in the old shallow field early this year.

Rocky Mountain Drilling Co. rig under way to the 14,000-ft. upper Pliocene sand pool discovered by Standard Oil Co. of California 1 Sespe Ranch near Fillmore. This test, 2 Sespe Ranch, is a southern stepout.



Sun Drilling Co. rig as it neared completion of a D-7 zone producer for Continental Oil Co. in San Miguelito field.

Pike Drilling Co. rig on the beaches at West Montalvo.

. . . Here are some representative big rigs that are making hole in the Golden Gate State

Bell & Burden rig on a Continental Oil Co. well in San Miguelito field, drilling toward the D-7 zone.

Shell Oil Co. workover rig redrilling a well from an "island" in Ventura Avenue field.

Drain Holes for Tired Old Wells

This new tool shows promise as a means of prolonging a well's life

by D. H. Stormont
West Coast District Editor

ADDITION of horizontal drain holes in depleted or semidepleted oil sands, as a relatively inexpensive means of prolonging a well's economic producing life, is tending to become more widely used as a remedial tool by some California operators.

More work is necessary before the potentialities and limitations of the practice can be fully evaluated. But when properly engineered drain holes are completed in formations containing reasonable quantities of recoverable oil, satisfying increases in oil production and improved decline characteristics have resulted.

Techniques and equipment for carrying out the work, in either cased or open holes, have been perfected to the point the drain-hole drilling operation is almost as trouble-free as conventional drilling.

Drain-hole drilling originally was carried out solely in new holes for the purpose of increasing a well's drainage area. Through reducing resistance to flow, most of which occurs near the vertical bore according to laboratory studies, the lateral holes should benefit oil production and ultimate recovery.

Hundreds of wells throughout the continent received such treatment during the past quarter-century. Most of the work, however, was in marginal wells. Often it was a last resort, after all other aids to increasing production had failed.

Likewise, it largely was performed for small operators, with but little or no engineering consideration given the job. Accordingly, results of drain-hole drilling have not been too well recorded.

New tools and improved techniques developed in the past few years have brought about more widespread acceptance of the value of drain holes. The flexible drill pipe being used today can change from vertical to horizontal drilling in a vertical depth of less than 10 ft. and in a drilled depth of less than 20 ft. Yet its tensile strength is almost that of conventional drill pipe.

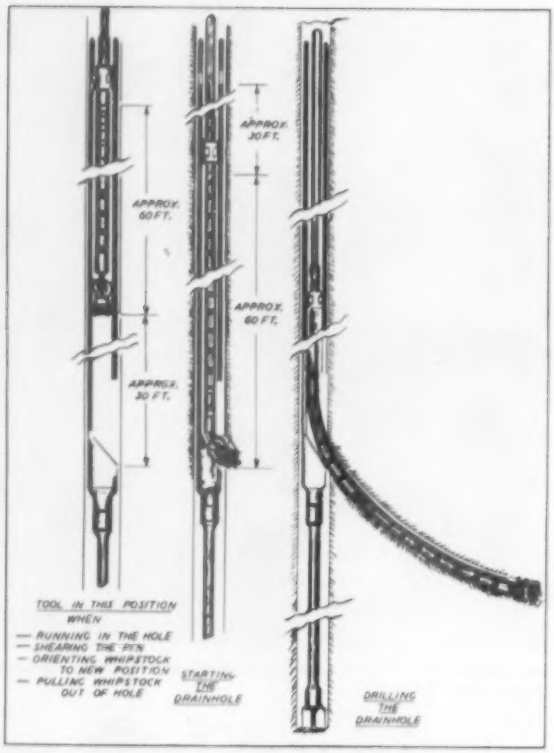

APPROX. 30 FT.
APPROX. 60 FT.
APPROX. 60 FT.
APPROX. 30 FT.
TOOL IN THIS POSITION WHEN
— RUNNING IN THE HOLE
— SHEARING THE PIN
— ORIENTING WHIPSTOCK TO NEW POSITION
— PULLING WHIPSTOCK OUT OF HOLE
STARTING THE DRAINHOLE
DRILLING THE DRAINHOLE

Fig. 1—This technique of drilling drain holes utilizes a flexible drill assembly and a whipstock with a length of anchor pipe.

The one change in techniques which has been of greatest benefit to the method has been that of installing liners in the drain holes. Failure to run liners is believed to have caused more drain-hole failures than any other one factor. This is particularly true in California fields, where the sands are more unconsolidated and prone to slough.

As a remedial tool . . . Until recently, drilling drain holes through casing was regarded as little more than a promising practice. A few holes had been so handled but techniques were not well established.

In the past few months at least five wells were provided with drain holes, usually two to four in each, after windows had been milled through casing or liners. No mechanical failures occurred in the flexible drilling assemblies used in preparing the windows and drilling the lateral holes.

Drain holes were provided in more than 100 other old wells during the past 2 years. In these cases the liners were pulled, drain holes drilled, new liners provided in both the lateral and vertical holes, and the well then restored to production.

In these remedial jobs, lateral drilling was chosen as the preferable and most economical means of satisfying redrilling requirements. The operators wished to obtain more oil through improving drainage from a semidepleted reservoir. Or perhaps the liner had become plugged, or production had fallen off because of water block. Whatever the cause, drain holes were chosen as the remedy in preference to plugging back and redrilling a new hole into the pay.

Costs of carrying out the remedial work varied widely, depending upon whether drilling was in open hole or through a casing window, whether liners were used, and other factors. In all cases, it was possible to carry out the work with a light workover rig, instead of the larger rigs usually required for a redrill job. Thus in some cases the cost of drilling the laterals was only some $3,500. In other wells where more footage was drilled and more services offered, total costs ran as high as $18,000.

Techniques used . . . Before taking up case histories of some of these wells, the equipment and techniques being used today will be briefly described.

The two firms which currently are performing all drain-hole drilling in

Tool Pusher's Reference

California, and whose tools account for practically all work outside of the state, are Oilwell Drain Hole Drilling Co. and Universal Engineering Co. The former drills solely from a high-angle whipstock. The latter principally makes use of a preformed, curved drill guide, but also has patent coverage for using a whipstock to deviate from the vertical bore.

As illustrated in Fig. 1, Oilwell Drain Hole makes use of a flexible drilling assembly inside a section of flush-joint, high-tensile casing which acts as a sheath pipe and holds the whipstock*. Sufficient anchor pipe is placed below the whipstock assembly to place it at the desired height above bottom of the vertical hole.

The flexible drill string is made up inside the sheath-whipstock assembly and run into the hole. Rupturing of a shear pin frees the flexible assembly, permitting the bit (or mill) to rotate while the sheath pipe and whipstock remain stationary.

* "Increasing Drainage of Oil into Well by Drain-Hole Drilling," The Oil and Gas Journal, August 17, 1953, page 105.

Fig. 2—A curved guide, preformed to a 27 ft. radius, is used in conjunction with flexible drill collars to accomplish the hole deviation in this system.

After a drain hole is completed, the drilling assembly can be pulled back inside the sheath pipe, the whipstock assembly faced in a new direction, and another lateral hole drilled. The assembly can be left in place and the flexible drilling string removed whenever it is desired to change rock bits, or to change from a milling tool to a rock bit.

The flexible drill pipe used by Oilwell Drain Hole consists of standard drill collars torch-cut in a four-lobe pattern. Design of the cut assures a complete universal action during rotation in a flexed position. A universal joint provided below the flexible pipe and above the bit serves to pilot the flexible drill collars and to insure a constant rate of drift-angle increase.

The tools and techniques used by Universal are those developed by John Zublin. As shown in Fig. 2, deviation from the vertical hole is accomplished by the curved section of pipe forcing the bit against the side of the hole.

The curved guide, nonrotating, is preformed into a curve of 27-ft. radius. Radial dovetail cuts equally spaced along its length give resiliency in the plane of curvature only. The pressure the pipe exerts against the side of the hole, more than 1,000 lb. in a 7⅝-in. hole, causes the bit to first drill a shoulder and then to deviate into the lateral hole.

Several sections of flexible drive pipe, made up of dovetailed intermeshing segments, are run immediately below the drill-pipe subs. Smaller drive pipe inside the curved guide transmits torque and weight to the bit on its lower end. High-pressure hose carries drilling fluid through these flexible portions of the drill string, as is also the case with Oilwell Drain Hole's tools.

In use, sufficient lengths of flexible drive pipe for drilling the desired length of drain hole are made up, along with the curved pipe. The tools then are lowered into the hole to the point where a drain hole is to be initiated. A clutch, which locks the inner drive to the curved guide while the string is being lowered, provides the means for orientation.

To cut the initial shoulder the brake is chained and the table rotated at moderate speed with moderate pump pressure. After a few minutes, the brake is slowly fed off until the weight indicator shows the bit is taking weight. From this point normal drilling procedures are used for the remainder of the hole.

Size of the casing set in the main bore determines the size of drain hole which may be drilled by either technique. Most holes have been drilled using either 4¼ or 4½-in. flexible pipe, working in open hole or casing ranging from 7 to 8⅝-in. or larger. Some work has been done in 5½-in. holes using 3½-in. pipe.

Because all drilling is done in the producing formation, fluids used should deposit as little cake as possible. Oil-emulsion mud sometimes is used but crude oil has been the most widely used.

Case Histories of Drain-Hole Drilling

AS mentioned earlier, results gained from drain-hole drilling have not been too well recorded. Likewise, because of the large number of variables involved, it is difficult to say whether increased recovery is due to the drain holes alone, to better completion practices, or to just what. In the following briefly described remedial jobs, reasonably good payouts resulted from the work, regardless of what was credited with the increased production.

A well completed about 3 years ago by a major oil company near Santa Paula, Calif., had an initial production of 29 bbl. daily. Its output was down to 6 bbl. in 30 days. One month before the remedial job was undertaken, the well was averaging 5 bbl. daily.

Drilling off a high-angle whipstock, a window was milled through 7-in. casing. Then 100 ft. of drain hole was drilled at an average drift of 50° and 100 ft. of flexible perforated liner was set. This procedure was repeated four times in a 5-day period.

Less than 1 hour was required to mill out each casing window through the 20-lb., H-40 casing. The whipstock and sheath pipe remained in the hole while all four 4½-in. drain holes were being drilled, and was not pulled until each liner was landed on bottom and detached. A bridging plug set in the perforated liner to eliminate bottom water acted as a foundation for the whipstock.

Initial output, in April 1954, of the reworked well was 59 bbl. daily. After 90 days, it was producing 54 bbl. daily. In August, 4 months after the work was performed, its output was about 50 bbl. daily. Average output of the field's 12 other producers at a comparable stage in their producing life was less than 16 bbl. daily.

In Edison field . . . A well originally completed in Edison field in June 1944

"Drain-hole drilling holds considerable promise as a method of reworking old wells."

also indicated that drain holes benefited its production when they were added 3 years ago. Unable to pull the liner, the operator milled a window in the 7-in. casing and redrilled from 4,144 to 4,297 ft. Four 4¼-in. drain holes, varying between 18 and 44 ft. in length and averaging 27 ft., were drilled at starting depths between 4,246 and 4,268 ft. The main bore then was gravel packed and the well placed on production.

Initial output following the remedial work was 45 bbl. daily. This naturally declined to a settled production of 7½ bbl., as compared to an average of 3 bbl. daily just prior to the work. In the 18 months following the work, 5,000 bbl. of crude was produced whereas in the like period before recompletion the well's total output was 2,400 bbl. More recent reports on the well's performance showed it was declining at a less rapid rate than originally.

In Torrance field . . . Several wells completed in 1924 in Torrance field have been changed from 5-bbl. strippers to 30 to 35-bbl. producers through the addition of drain holes. These increases were maintained for considerable periods of time so that the operator concerned is quite pleased with the results.

A well which had not been produced since 1929 was redrilled from 3,100 to 3,800 ft. and then provided with eight lateral holes averaging about 75 ft. in length. The holes, drilled at a rate of 7½ ft. per hour, were not provided with liners, nor was the main bore.

The first 2 days following recompletion the well averaged 39 bbl. daily. Yield settled to about 20 bbl. daily during the next month and a year after completion was 19 bbl. daily. At that time, this represented a 14-bbl. increase over the average daily output of other wells on the lease. Production did not seem to be declining materially from that level at last report.

In Wilmington field . . . Several jobs completed in nearby Wilmington field likewise have materially benefited old wells, particularly in the degree to which the increased output has been sustained. Last October a well which had yielded over 300,000 bbl. of oil since its completion in 1937 was provided with six 75-ft. laterals. From 1947 to the day it was reworked, the well pumped 8 to 10 bbl. daily. Its new initial production was 51 bbl. of oil daily and its settled production will be between 30 and 35 bbl., it is estimated.

Success of these jobs is being credited largely to the special prepacked liner used. Ordinary slotted 2-in. tubing was prepacked with 1 in. of gravel around its exterior, and this held in place with an open-mesh screen. A soft metal adapter, about 4 ft. in length and tapering from 8 in. to the same size as the liner, was run on the inner end of the liner.

Length of the liner and adapter was made such that the adapter fit into the mouth of the drain hole, supporting it at this critical point and preventing sand from plugging the liner. The end of the liner protruding into the main bore then was milled off using a mill run on the drill pipe. Following this, an ordinary prepacked liner was set in the main bore.

In Coalinga field . . . Another example of rejuvenation brought about by drain holes was carried out in Coalinga field by a major operator. There seven old producers were provided with four 100-ft. lateral holes each. Average cost of pulling the liners, drilling the 4½-in. drain holes, and then providing them with 3-in. liners was about $18,500.

The wells had declined to about 3 bbl. daily after having been completed some 2 or 3 years, at which time their initial production averaged about 77 bbl. Immediately after drain holes were provided, their average output was 36 bbl daily. In July, after some of the wells had been recompleted for more than a year, average output was 25 bbl. daily.

The operator is not willing to credit all the increased production to the drain holes alone, in the belief that other factors have to be considered. The operation has been economically feasible, it is admitted, and is indicated by the fact work is under way on an additional six-well program.

In this program the 4½-in. drain holes were drilled using the same type of oil-base mud as had been used in the original completions. After the 100-ft. holes had been drilled and flexible liners provided, main-hole liners then were provided before the wells were restored to production.

At Signal Hill . . . Although not a remedial program, drain holes were directly responsible for a 14-well drilling flurry in a depleted zone of Signal Hill field. Originally developed years ago, one edge area of the pool had been only partially drilled because of the poor wells yielded. Conventionally drilled wells had initial productions of about 25 bbl. daily and declined so rapidly a payout could not be obtained.

The drain-hole wells completed in this area about a year ago had an average initial production of 75 bbl. daily, or three times that what might be normally expected. Little is available about how the wells declined, because of a competitive situation, several wells are believed currently to be averaging more than 28 bbl. daily.

In these wells usually six 50-ft. laterals were drilled in two stages of three holes each. About 2 days were required for drilling the holes. Cost of the work was approximately $3,500 per well, including rig time and service charges.

Decline rate slowed . . . From these case histories it appears that drain-hole drilling thus holds considerable promise as a method of reworking old wells. Although initial producing rates not always are substantially above those completed without drain holes, the decline rate appears to be lower and ultimate recovery higher for wells equipped with drain holes.

Another field in which drain-hole drilling techniques show promise is through increasing the amount of penetration which may be obtained in steeply dipping formations. Because the tools can deviate from the vertical bore in such a short drilling radius, they could be used after the pay is encountered to drill at the same drift angle as the dip of the formation. After the hole is deviated so that it is paralleling the dip, at an angle of 45° for example, several hundred feet of pay thus could be cut before the well is bottomed. In pays having a wide range of permeabilities, the bore could be confined solely to the better portion of the pay.

"Our retirement present is a little different, John. Instead of watches and money we're giving this—."

Tool Pusher's Reference

What you should know about

Field Control of Completion Fluids

Specialized completion fluids are coming into more widespread usage. Usually, they can prevent severe contamination of the producing zone and subsequent lowering of productivity. To accomplish this, completion fluids must have the proper care.

by D. L. Roberts

A COMPLETION fluid is expected to accomplish the following, in addition to the usual functions:

1. Insure maximum well productivity by reducing invasion of producing sands or, (if invasion occurs) reducing deleterious effects to the minimum.

2. Obtain maximum drilling rate, thus reducing time spent in zone. The primary desirability of time reduction in zone is increased productivity. Decreased rig and tool costs follow automatically.

3. Obtain maximum stability and flexibility of control.

4. Obtain best possible electric logs, core samples, side-wall samples, etc.

5. Obtain characteristics listed above at minimum cost.

There seems to be no evidence to indicate that slight variations in weight, viscosity, or fluid loss can be credited with an alteration of productivity. However, such slight variations are often warning of major changes. These, in turn, often do adversely affect productivity. A high degree of inherent stability, and adequate control of the fluid to maintain this characteristic, are essential.

Instability can cause loss of weight due to dropping out of weighting materials, with the attendant danger of loss of control. Conversely, if completion technique emphasizes maintenance of a clean drilling fluid (as when pump packing gravel in low-pressure, dirty sand zones), an increase in weight is almost always due to entrapment of detrital material in the fluid. Even more important is prevention of emulsion inversions, with accompanying hydration and sloughing of shales or excessive filtrate loss to the zone.

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Effect of filtrates . . . Much of the work that has been done relative to damage by drilling-fluid filtrates to various types of zones points to the conclusion that injection of water different in composition from that initially contained by the zone can, and often does, reduce productivity. The effect of hydrocarbon and synthetic filtrates has not been as thoroughly analyzed. The most obvious method of maintaining filtrate loss damage to a minimum is to prevent loss of filtrate to the zone; a very successful trend along these lines has been under way for several years. As a result usable fluids can be compounded which will maintain a zero filtrate loss under the conditions of A.P.I. tests for many hours, with good assurance that filtrate loss to the zone in actual use will be extremely low.

Maintenance of viscosity control is often somewhat more difficult (particularly at higher temperatures) than is the case with good-quality clay-base mud. Excessive filtrate loss from special-purpose fluids often adversely affects viscosity, necessitating additional control measures, which in turn require additional drilling time to be spent. It can thus be seen that high inherent chemical stability has more than one value. Furthermore, characteristics which may not appear markedly disadvantageous in laboratory investigation can have "chain" reactions which result in most undesirable characteristics under field conditions.

Teething troubles . . . Many operators who have had only a small amount of experience with special drilling fluids seem to believe that excessive control efforts are necessary because of the special composition. Difficulties certainly have arisen with each new type of fluid introduced, regardless of the composition or purpose for which the fluid was developed. The writer well remembers difficulties encountered with one of the first uses of a starch-base material in California and also with several of the "red mud" materials evolved for drilling salt, gypsum, etc. These difficulties can be properly classified as "teething troubles" and have usually been due either to lack of correlation between laboratory and field results, or to misapplication of the fluid.

Laboratory tests are seldom completely indicative of field performance because they often fail to include such factors as pressure, temperature, age of the fluid, previous treatment history, and effect of contaminants. Laboratory emphasis, however, should not be on testing the multifarious combinations possible between these factors, but on the basic chemical and physical characteristics of the material. Then supplemental tests used in the field, plus intelligent observations and the application of reason, will solve the difficulties.

It has been the writer's experience that after the teething troubles are overcome, specialized completion fluids (regardless of composition) require only a little more testing than do treated clay-base fluids. Often this factor is more than offset by reduced treatment of inherently stable fluids as compared to same specialized clay-base mixtures.

As fluids are more and more specialized for particular applications (drilling through salt and gypsum beds, application to low-pressure zones, etc.), the engineer must use more and more care in selecting (or drawing up specifications for) such fluids. The fact that a fluid will successfully withstand high gypsum concentrations may be of absolutely no value to a given operator who does not contemplate drilling gypsum beds. Moreover, selection of such fluid may markedly increase cost

for his application without compensatory benefit.

Don't overload crew . . . Because some of the characteristics of completion fluids are diametrically opposite to those of clay-base mud, a period of crew education is always required. For this reason, where conditions permit, it is unwise to employ a wide variety of completion fluids, each of which may require a distinctly separate maintenance technique and set of additives. Once standard crew maintenance rules have been established, they can be as easily administered as safety rules, or operator's policy covering any other phase of the operation. Since we expect more of a completion fluid, some additional effort in its testing, treatment, storage, etc., is fully justified.

What's to be checked . . . The characteristics of completion fluids which are normally relied on for field and laboratory checking are:

1. Weight.
2. Viscosity; also viscosity-temperature relation.
3. Water content.
4. Solids content; at times it is necessary to distinguish between solid contaminants and weight additives.
5. pH.
6. Yield (in terms of barrels of base oil and primary additives).
7. Time — temperature —concentration curves of additives used; especially those for viscosity and filtrate control.
8. Some measure of suitability, and basis for evaluation of standardization of various base oils (if used).

In the case of several commonly used completion fluids, from one to two checks per tour of weight and viscosity, plus one daily check in the laboratory of fluid loss, oil-water ratio and contained solids, are adequate. These measurements are also normally adequate to (1) measure the necessity for reconditioning; (2) define the type and quantity of additives, agitation, screening, etc., necessary for reconditioning; (3) determine whether or not reconditioning is satisfactory.

Two types in the past . . . Efforts that mud supply and service firms have made in the past can be broken down into two general fields. First, some firms have tended to develop mixtures with minimum regard to chemical principles involved, and then attempt to induce some luckless operator to work out the teething troubles in the field. Such efforts are usually foredoomed because the basic understanding of the fluid's characteristics is not available. This inevitably increases rig cost, may endanger the well, and often produces a suspicious attitude towards similar fluids on the part of the operator. It is true that such fluids have been rather extensively used in the past. However, the fluids in widest use today have been developed by use of adequate laboratory experimentation.

The second class of fluids is composed of those of which an adequate understanding of the basic characteristics was obtained before use. In addition, upon start of field use, laboratory work was done to determine why previous laboratory tests or well pilot tests failed to indicate reactions in the hole. There have been instances in which field observations indicated the line of laboratory analysis necessary, and often such laboratory investigation clearly revealed the cause and correction of field anomalies and difficulties.

In general, mud supply and service firms which have developed products along the lines described in the second classification above have done an excellent job. They have certainly done much towards substituting cheaper, better, or more easily available materials, particularly substitutes for those which field tests proved to be too expensive or to have a narrow range of application.

Field engineer's role . . . Some mud suppliers and service firms have failed to obtain the correct relation between crew, service engineer, and laboratory technician. This condition is not inherently difficult to rectify. Normally the field engineer must act as liaison between the laboratory, the management of his firm, the management of the operating company, and the crews. This function requires a good knowledge of his product and well procedures, as well as tact and the ability to clearly express his views. Specific cases come to mind where field service engineers seemed technically adequate, but so deficient in the other characteristic that their efficiency was less than satisfactory.

The role of the field service engineer is made more important by the fact that few trained chemists have had field experience; for instance they are not always aware that the easiest way to make up mud volume on a drilling rig is to turn a 2-in. stream of water into the ditch. As specialized drilling fluid problems become more and more chemical in nature, the tendency among service firms has arisen to hire young chemists or chemical engineers as service men. Such procedure can be disastrous unless the young engineer can be given adequate training under proper supervision, and unless such training results in the man thinking in oil-field terms—stuck drill pipe, drilling rate, core recovery, blowout prevention, etc.

The average driller and tool pusher knows little and cares less about chemical treatments and balances. He depends almost entirely on the service engineer for such knowledge. He also expects the service engineer to either know or find out about the physical difficulties resulting from completion-fluid unbalance, treatment, etc. Certainly mud-control work is practical chemical engineering. Young chemical engineers who have indicated a desire to enter the drilling-mud field (and allied fields) should obtain practical rig experience before a considerable investment in time and money is made to give them specialized training in mud control.

Other compromises have been used satisfactorily. Some service engineers are "graduates" from drilling-rig crews and have been trained by the mud company in the basic chemical precepts necessary for his daily work. Alternatively, most young petroleum engineers have a good knowledge of basic chemistry. After adequate rig training, or field training in general petroleum engineering, such men often do excellent mud-control work.

How often to check? . . . The major criticism of service companies is that their engineers fail to make quick and simple checks of mud systems often enough. As discussed above, adequate specialized control of completion materials is often beyond the scope of rough-and-ready means. Indeed application of such means by rig crews in the absence of a trained engineer may seriously damage the fluid, and may even endanger the well. Some specialized fluids can and do change characteristics very rapidly. The required frequency of testing and the checks to be made are a function of the fluid characteristics, the degree of drilling-crew education, and the depth of the hole, with particular relation to temperature and pressure.

A wide variation of temperature gradients, even in relatively shallow fields, exists in California. Such gradients range from ¾° per 100 ft. with surface temperatures as high as 112°, to gradients approaching 3° per 100 ft.

with average surface temperature of approximately 70°F. Pressure depends on depth and actual fluid gradient. The term "actual" is used because some materials are inherently susceptible to gas cutting or contamination by zone crude; the latter may be markedly higher or lower in gravity than the completion-fluid base oil.

In sum, the frequency of testing and the checks to be made are definitely the result of experience. The writer has seen experienced service men correctly judge that no check was necessary for 48 hours without bad results. Instances have been observed of service men literally living on the job, succeeding only in keeping the mud badly out of balance for days at a time.

How about using crude? . . . During a period of years many attempts have been made to complete wells with both crude oil and mixtures of crude and refined oil. Such efforts ranged from planned attempts, to use of oil as a last resort because of large completion-fluid losses. In highly permeable low-pressure formations (particularly where a large amount of zone is to be drilled) experience indicates that use of properly compounded fluids is superior economically to use of crude oil and even more superior to use of crude-refined oil mixes. During such attempts considerable quantities of crude have been lost to the formation, drilling rate has been unsatisfactory, and solids-content control unsatisfactory without exception. Attempts to adjust viscosity of crude oil by addition of refined oils have been costly and mechanically unsatisfactory.

Experiments of this nature should not be conducted by personnel untrained in control of the resulting fluid on an oil well, but should be conducted in a laboratory by trained personnel having the assistance of field-trained engineers. In order words, attempts to control any of the characteristics discussed above when using crude oil are merely a crude effort to make an oil-base completion fluid in the hole. Any such attempt foregoes the tremendous advantage of intelligent use of the large number of chemical agents available today which can be used to stabilize emulsions, prevent inversion, control viscosity and fluid loss, reduce fire hazard, and thus increase drilling rate and productivity.

When fluid loss is heavy . . . In the case of using oil to displace heavy completion fluids because of excessive completion fluid loss in the zone, experience has shown that a definite reduction of productivity can be expected. This raises two questions—

1. Was the productivity reduction due to the loss of the completion fluid?
2. Was it due to loss of large volumes of oil (probably of markedly different composition from that originally contained in the zone)?

In either case, the method of prevention is to prevent loss of fluid to the zone. Such prevention is one of the primary reasons for adoption of specialized fluids. Fluids which can be maintained at 61 lb. per cu. ft. have high resistance to "spurt," and reasonable viscosities, are available from several firms. Furthermore, present research indicates that further increase of these characteristics is possible and economic, although usually at some additional cost.

The experience discussed above in attempting to complete with crude oil indicates strongly that it is better to use completion fluids available for the purpose, even though risk of circulation loss with crude oil is not known to exist. The point at which the completion fluid which is being lost in excessive quantity to the zone should be displaced by crude oil is more usually determined by drilling economics (cost of completion fluid vs. that of crude) than by evaluation of the effect of circulation loss in the zone. Far more certainty exists of losing large quantities of oil in the zone than of losing large quantities of completion fluids in the zone.

Precautions to take . . . Due to the high value and special composition of many completion fluids, special precautions may be necessary in storing, shipping, plant reconditioning, and rig use of such materials. Tight, easily cleaned ditches and pits, and often special shaker screens, are essential, as is training of personnel to thoroughly clean out tanks, lines, and vacuum trucks, and to take special efforts to recover all completion fluid possible. The latter point is especially important when displacing completion fluids from a well. The rate of displacement, method used (tubing to bottom, etc.) can markedly affect economics of completion-fluid use. Reconditioning plants which are not designed to safely handle flammable materials may require some modification.

Accounting can save money . . . The importance of proper mud accounting increases in direct ratio to the value of the material. While many systems have been used, the most efficient in the judgment of the writer is the assignment of responsibility to one individual, or to a small section. Such assignment to a head well pusher, a mud engineer, or to one or two petroleum engineers, is usually successful. Due to loss of identity of each lot of mud which is reused, and the necessity for specific treatment of such mud on the well, the accounting may be more complex and difficult on high-cost completion fluids than on low-cost fluids. This is primarily due to necessity for maintaining correct water-oil ratios and to the large variety of materials which may be used for treatment.

In one case, institution of good mud accounting required by use of high-value muds was later extended to accounting of clay-base mud; surprising economies were realized.

Not necessarily expensive . . . Any impression which has been given by this discussion that specialized completion fluids are inherently costly, difficult to control, or hazardous (provided the fluid is properly chosen), should be corrected. The fact that many operators are using large quantities of high-first-cost completion fluids is a sure indication that the returns obtained by such use more than repay the additional expense. None of the tests or processes referred to in the article are in themselves complex or difficult.

The application of good mud accounting, basic principles of chemistry, and full utilization of practical laboratory checking and control can assure success with any correctly chosen completion fluid. Without question, some completion fluids, due to their specialized nature, can be misapplied; this should be guarded against by application of experience of other operators, or by being certain that the basic physical and chemical characteristics of the material make it applicable to the specified area before field use is attempted.

Completion-fluid technology has been marked by a series of advances in recent years. Evaluating these advances shows it likely that completely synthetic fluids having even more desirable characteristics may become commercially available within the next few years. Of these characteristics, high stability, wide weight range, ease of control (particularly of weight and viscosity), and lowered cost are to be particularly desired.

Fig. 1—A section through a shrink-thread tool joint after hardfacing by the manual acetylene method as it is done in the field shows the depth of heat penetration (light area) and the hardness reduction.

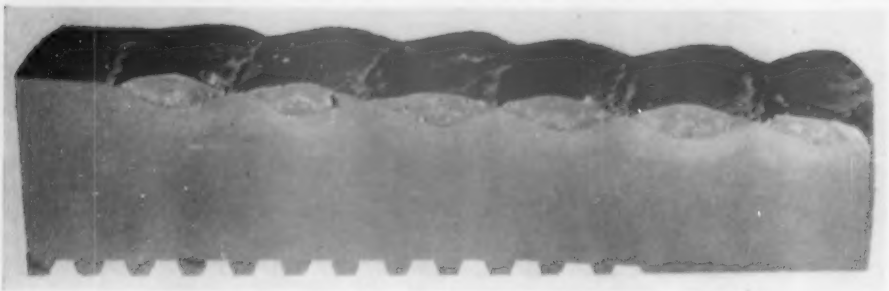

Fig. 2—A section from a shrink-thread tool joint hardfaced by the continuous machine method with tungsten carbide deposited in machined grooves shows good fusion and uniform contour of each bead. The heat-affected zone under each bead is shallow, thus preserving the full strength of the base metal.

Good Results From Field Hardfacing

by C. Swartsfager

PORTABLE automatic electric machine welding appears to be the best field method of hardfacing and is gaining favor over the two common manual methods—acetylene welding and electric arc welding. Its advantages are provisions for closer control, faster and more uniform application of hardfacing materials, and ability to apply heavy deposits with minimum heat penetration. The machine is similar to that used by tool-joint manufacturers in their plants.

Hardfacing became an established field practice because of its possibilities in extending the life of worn tool joints. It has proved effective and economical when done properly. However, field methods have often given far less than the desired and possible results.

The major problems of drill-pipe users in recent years with respect to endurance of tool joints have been overcome to a large degree by improvements in design and use of better materials. Nevertheless, drill-pipe manufacturers and their field, production, and research engineers continue in their efforts to make drill pipe last longer. One of the ways of doing this is by hardfacing tool joints.

Some field jobs bad . . . Investigations have shown that the success of hardfacing depends upon a number of factors which can often be held under better control than present individual practice. The results of hardfacing, as now practiced in the field, vary widely in the degree to which they make tool joints last longer.

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The reason for poor results is usually excessive heat which penetrates and weakens the parent metal. No subsequent heat treatment can be applied in the field to correct the detrimental effects of this heat penetration. Heat penetration depends upon the speed of application, skill of the welder, and the method of hardfacing used. A sufficient thickness of the worn walls of the tool joint is the most important factor in the success of hardfacing.

In contrast to field practice, the machine method of applying hardfacing materials during the manufacture of new tool joints provides closer controls than are possible in the field, especially with manual methods. Since this is true, and since there are many pitfalls, such as too rapid cooling, in the field application of hardfacing, regardless of the method employed, the recommendations that are given here are offered without assuming any responsibility for results. They are, nevertheless, steps in the right direction.

Two types of tool joints, the shrink thread and the integral type, present slightly different problems with respect to hardfacing. The inducement is greater and the risks often less with integral-type tool joints because they cannot be readily replaced in the field and they have a thicker wall without pipe threads underneath.

The manual acetylene method of hardfacing is not recommended for the heat-treated shrink-thread tool joint because its excessive heat penetrates the parent metal with detrimental effects. Further heat treatment after field hardfacing, though essential after such application of hardfacing material, is impossible for the already-shrunk-on type of tool joint.

The results of a laboratory examination of a section of a tool joint to determine the depth of heat penetration and the hardness reduction in the heat-affected zone are shown in Fig. 1. The changes in physical properties of the parent metal caused relief of shrink stresses, thus loosening the connection so that failure occurred.

Electric arc is faster . . . The manual electric arc is much faster than the manual acetylene application and should induce less heat into the joint. However, the time element still plays a major role, especially if a thick deposit is required. The result is then practically the same as that produced by acetylene welding with deep heat penetration and reduction of hardness in the parent metal. Shrink stresses can be relieved enough in the tool joint to bring ultimate failure.

Since the electric hardfacing metal (tungsten carbide) expands and contracts negligibly with temperature variations, many cracks develop in the deposit if it is permitted to cool too

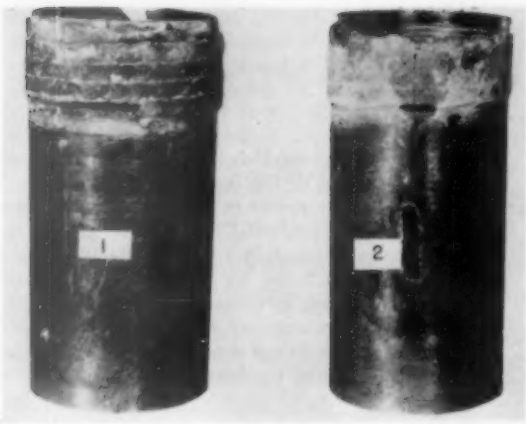


Fig. 3—Failure of two 4½-in. internal flush tool joints after being hardfaced by the portable automatic machine method. The crazed condition of the deposit in joint No. 1 was made visible by Zyglo. This cracking was partly responsible for the splitting best shown in joint No. 2.

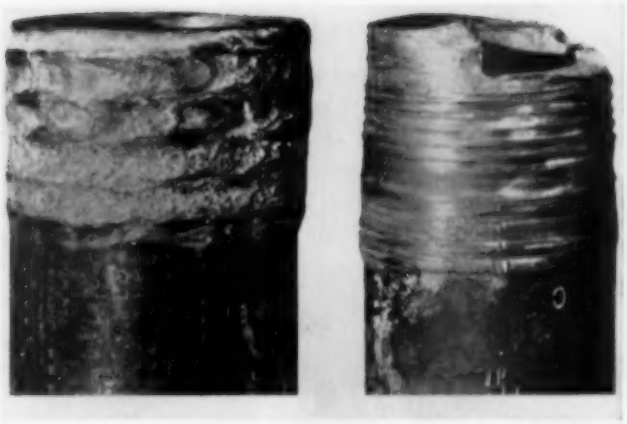


Fig. 5—Failure of this tool joint, No. 5 in Fig. 4, resulted from a loose connection and wobbling action in drilling service. Welding heat caused shrink stresses to relax and the hardsurfacing metal prevented the joint from returning to its original tightness.

rapidly. These cracks may extend through the wall of the joint, thus relieving the shrink interference and causing failure. The manual electric arc method also, therefore, is not recommended.

Automatic machines . . . Various automatic machines have been devised for the continuous application of hardfacing metals in factories. Machines incorporating the electric method are more commonly used than those with the acetylene method. All factors are under absolute control at all times to produce the best possible deposit. The result, shown in Fig. 2, is a uniform contour and fusion of each bead with minimum heat penetration.

The shallow heat line in Fig. 2 indicates that it is practical to deposit hardfacing metal on heat treated tool joints with factory-type machines without jeopardizing the physical properties of joints having a reasonable wall thickness. Precautions in the hardfacing operations include preheating to prevent the development of cracks in the deposits and post heating to relieve any stresses caused by welding.

Automatic Hardfacing Tested

Soon after the portable automatic hardfacing machine came into use, a series of tests were conducted where shrink thread tool joints were installed on drill pipe and each hardfaced experimentally in the field by the company which developed the portable equipment.

To simulate worn conditions the tool joints (4½-in. full-hole double-seal) were machined to wall thicknesses of 0.365 in., 0.428 in., and 0.553 in. After preheating each tool joint to about 400° F., a chrome-tungsten wire with Rockwell "C" of 50-52 was applied as base metal under a submerged arc to form four helical grooves. Then tungsten carbide of 20/30 mesh in coil form was deposited in these grooves to form four spiral bands. No stress-relief measures were taken in the field after hardfacing.

Hydrostatic tests of these joints to 5,000 psi. showed no leaks through the seals. Torque tests at 80 per cent (15,610 ft.-lb.) of the torsional yield in the makeup direction, which is considered satisfactory without destruction to the pipe body, did not move the tool joints. Furthermore no movement was apparent when test loads were increased to the maximum load at which the drill pipe was crushed out of round by the chuck jaws. These loads averaged 33,000 ft.-lb.

Inspection for cracks with oil and fluorescent powder revealed numerous longitudinal cracks across all beads of tungsten carbide and transverse cracks in the chrome-tungsten base metal. These cracks indicated the possibility that the preheat temperature may have been insufficient and cooling in air too rapid for these two materials.

To avoid any possibility of altering the new physical properties of the metal in the heat-affected zone directly under the hardfacing deposit, the hardfaced boxes were recovered from the drill pipe by machining the pipe "dutchman" out of each box.

Etched cross-sections from each tool joint revealed that the heat line was not excessive although two layers had been applied and the carbides had the

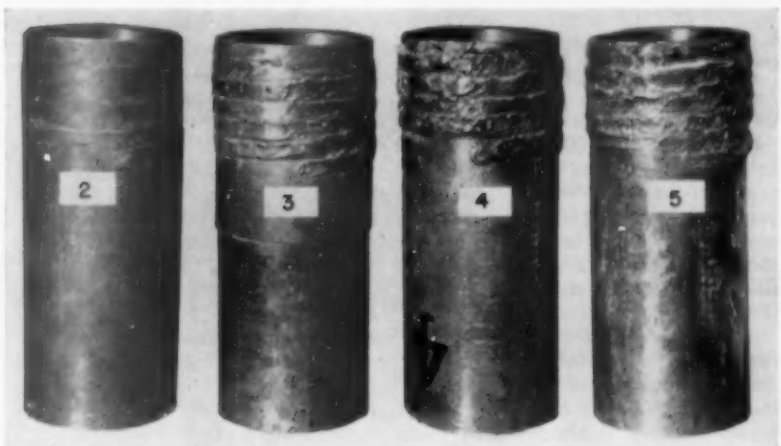


Fig. 4—These 3½-in. internal flush shrink thread tool joints were hardfaced by the portable automatic machine method and used. No. 2 shows most wear, No. 4 has an indication of welding rod burning through the thin wall near the elevator shoulder. No. 5 failed completely, as shown in Fig. 5.

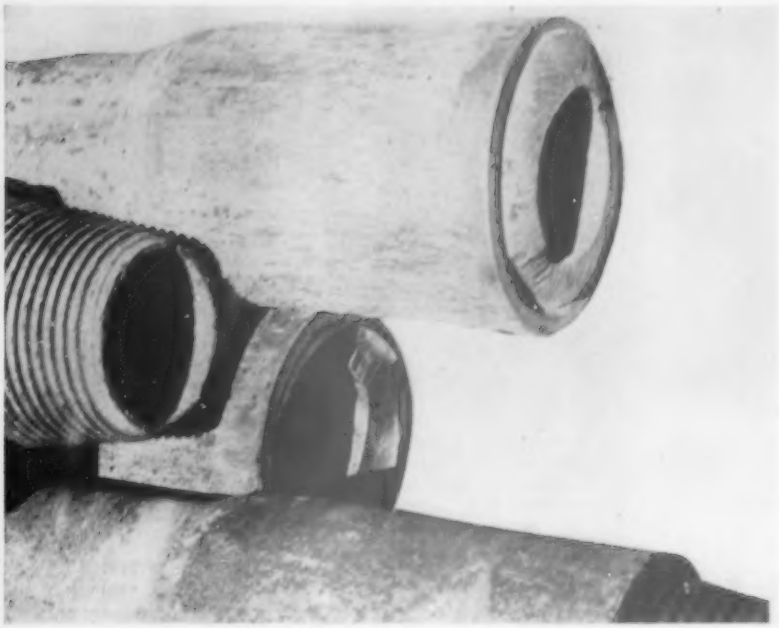


Fig. 6—Pin failure in integral-type joints resulted from the effect of prolonged heat while hardfacing the entire length of the tool joint.

Fig. 7—Poor welding technique is indicated by the undercutting or notch effect which could easily have contributed to this failure in the integral type box.

usual distribution. Rockwell "C" hardness readings in the heat-affected area indicated a slight reduction in hardness. Heat penetration in the joint with 0.365-in. wall approached the danger point. Consequently it is recommended that when walls are thinner than this they be considered too risky for successful hardfacing.

Why failure occurs . . . When excessively worn tools joints are hardfaced by the portable automatic electric machine method in the field, failures occur. Similar failures have also resulted from field applications of hardfacing to shrunk-on tool joints having relatively thicker walls when there is excessive heat peneration. This can occur as the result of variation in the technique employed by different individuals operating the portable machines and should not be construed as a condemnation of the method itself. Fig. 3 shows the types of failures encountered.

Thread wear and galled surface of the inner seal indicated creeping on the drill pipe during service. Consensus was that the intense heat in applying hardfacing wire on this thin-walled joint penetrated into the threads and relaxed the shrink stresses enough to loosen the connection.

Four specimens of 3½-in. internal flush shrink-thread tool joints that had been hardfaced by the portable automatic machine method and returned after field use are shown in Figs. 4 and 5. Most wear is shown by No. 2 and complete failure by No. 5 on which thread wear was caused by a wobbling action of the loosened joint.

The results of tests of hardfaced tool joints indicated that limits should be established before hardfacing, particularly on the wall thickness in the thinnest section of a tool joint, and on the eccentricity of wear. The recommended minimum wall thickness at the elevator shoulder is 0.365 in. until further observations may indicate some other limit.

Hardfacing Worn Integral Tool Joints

Integral-type tool joints present a greater inducement for field application of hardfacing than other types. The risks that result from field hardfacing practices have been accepted by users and apparently few failures have occurred in spite of the impossibility of subsequent heat treatment in the field.

Application of hardfacing metals by the portable automatic machine method to integral-type tool joints is being used extensively in both domestic and foreign fields. This method af application results in maximum over-all economy and best control of heat penetration. Failures of manually applied hardfacing metals warn of the risks taken. The automatic method makes possible heavy deposits of hardfacing metals with minimum heat penetration and permits faster completion of hardfacing jobs. The risks of failure are less on integral-type joints because of their thicker wall and absence of pipe threads underneath.

In general practice hardfacing metal is applied over a 3 to 4-in. area adjacent to the 18° elevator shoulder of the tool joint. Sometimes a string of flashweld drill pipe is conveyed to a field machine shop were grooves are machined in the tool joints and filled with tungsten carbide by the manual acetylene method. Although heat penetration can be excessive, the thick section under the hardfacing is usually ample to absorb the heat. There can be, however, a reduction of hardness in the heat affected zone.

In some instances the entire length of the tool joint is built up with weld metal. Both the slow manual acetylene method and the faster manual electric method were used. Full-length buildup manual methods result in more failures because the prolonged welding heat is high enough to change the physical properties of the tool joint steel. Figs. 6 and 7 show the effects on tool joints built up full length.

Drilling Records Toppling in 1954

Total completions, and total footage, climb to new highs. Here's an area-by-area rundown of where operators are making this record hole

by Norman S. Morrisey
Drilling-Development Editor

Rockies Move Into "Major Province" Status

THE year 1954 has seen the Rocky Mountains emerge as a major oil province, comparable to West Texas.

Well completions during the first 7 months of 1954 were at an all-time high with 1,386 producers and 921 dry holes. At the present time, development drilling is concentrated in four basins: the Denver-Julesburg; east side of the Powder River (Weston County, Wyoming); Williston; and San Juan. Although drilling problems, penetration rates, and mud programs are highly variable in the Rockies, operators have adopted fairly standard drilling practices in these areas of greatest activity.

Promise of a gas-pipeline outlet to the Pacific Northwest is the most significant development to date in 1954 in the Rockies. This has stimulated exploration and field drilling in the San Juan basin, eastern Utah, western Colorado, and southwestern Wyoming. Much of this vast area has never been tested by the drill and well control is sparse.

Key wildcats . . . Recent discoveries have brought previously undeveloped areas sharply into focus.

Successful wildcats on the Sweetgrass arch in northwestern Montana indicate that an intensive exploratory drilling campaign is shaping up for this area. Few deep tests have been drilled on the Sweetgrass arch, although it is an old producing area with fields such as Cut Bank and Kevin-Sunburst. Recent leasing of Indian lands in the Disturbed Belt reveal that oil operators are seeking another Pincher Creek in Glacier County, Montana, west of the Sweetgrass arch.

Deep Madison production at Beaver Creek in the Wind River basin of Wyoming is of regional importance.

Beginning on page 182 is a summary of drilling practices, contract prices, and other pertinent data on 71 active representative fields in the United States and Canada.

This formation covers a wide area in Wyoming and Montana and may be oil bearing on many of the large structures. Most of these fields are now producing from shallower zones such as the Dakota, Embar, and Tensleep.

Development drilling in the Williston basin has been largely confined to the known trends: Beaver Lodge-Tioga, Poplar, and the Cedar Creek anticline. Operators are now completing successful wildcats on seismic prospects and the outlook for more development and exploratory tests is excellent.

Mesaverde gas discoveries in the Green River basin, coupled with the proposed pipeline to the Pacific Northwest, are the prelude to a long-range exploratory program in this large sedimentary basin.

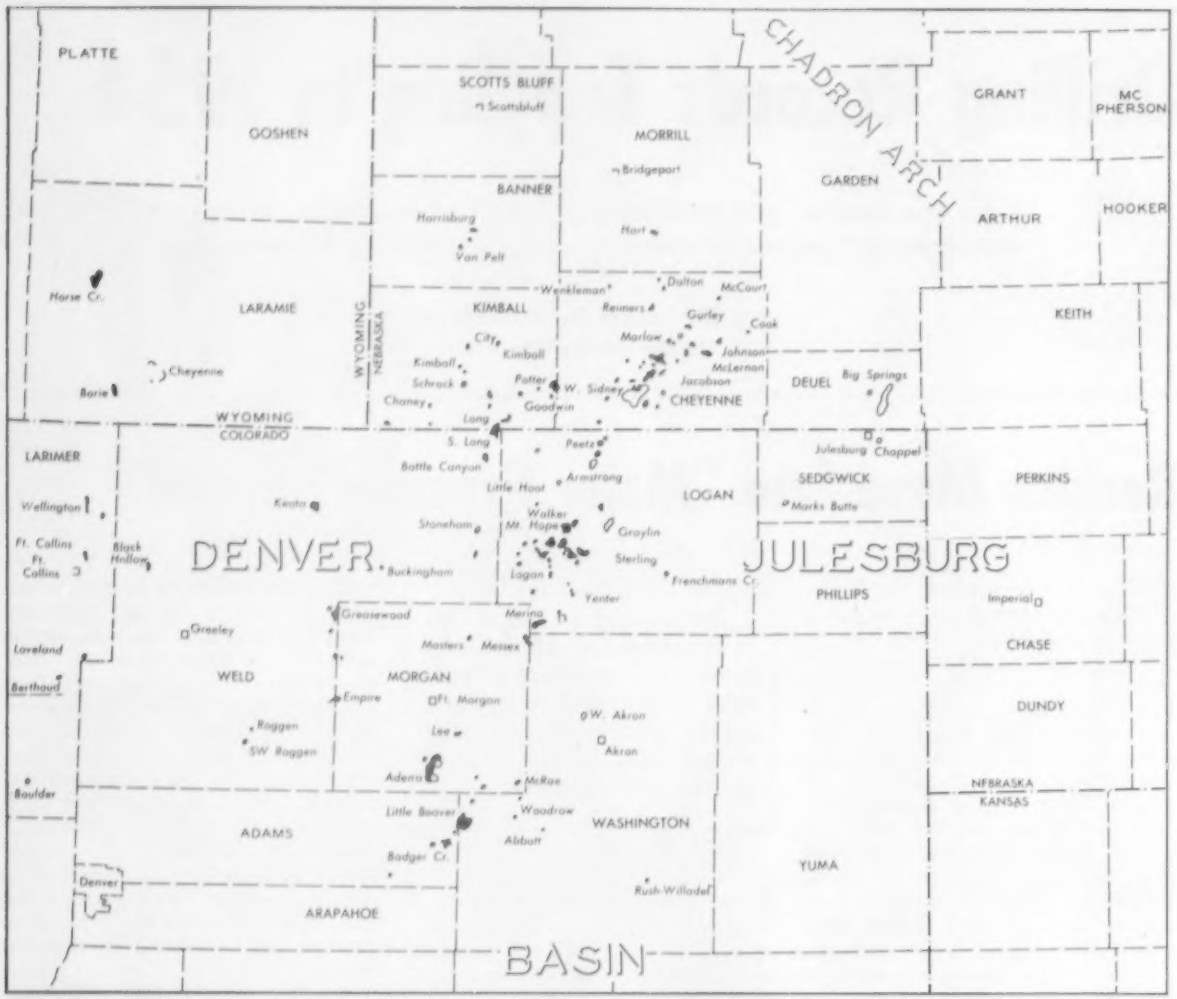
Clear Creek gas production in the Wasatch Plateau of Utah has sparked an active search for additional reserves. Several key wildcats are planned and the outcome of these will be closely watched. Exploratory drilling in the Paradox basin of southeastern Utah is on the upswing. This basin is virtually untested and the prospect for commercial oil and gas appears bright.

Activity increasing . . . Ten per cent of the Rocky Mountain rotary rigs are centered in the San Juan basin and drilling will continue to increase in this large gas reserve. In July 1954, operators completed 71 gas wells, up 56 wells over the preceding month. During the past several years operators have pursued an active drilling program designed more to build up reserves than to fill the requirements of a large market. Now the picture has changed radically with the Federal Power Commission's approval of a pipeline to Seattle and Portland. Pacific Northwest Pipe Line Corp. is committed to a large-scale development program, and other major operators are expected to increase the number of development wells.

Discovery of Adena in northeastern Colorado has rejuvenated drilling in the Denver-Julesburg basin and is the most significant development in the past 12 months in this area. Within 6 months this field became the second largest producing area in Colorado with a daily production in excess of 10,000 bbl. On the west side of the basin, the Lyons sandstone production at Black Hollow has touched off a series of deep tests along the mountain front.

Topeka lime development has spread into southeastern Colorado and activated this part of the state. In addition, the Keyes sand will eventually produce and stimulate development and exploratory drilling in this area.

Wyoming drilling is concentrated in Weston and Niobrara counties, in the Newcastle sand development. In the first 7 months of 1954 Wyoming had 785 tests with 571 successful and 214 dry, and at least 50 per cent of these tests have been in the Weston County play. Independent operators are most active on the trend and the outlook for additional development and exploratory drilling is optimistic.



Light rotaries are used on the east side of the Denver-Julesburg basin to develop the "D" and "J" sands, main pay zones. Deep production on the west side of the basin means more wells along the mountain front.

Denver-Julesburg Basin

Fast, easy digging is typical of the east side of the Denver-Julesburg basin with 5,000-ft. wells drilling in 8 to 10 days.

Drilling activities are at an all-time high with 70 rigs running. Principal pay zones are the Cretaceous "D" and "J" sands found at 4,800 to 5,500 ft., and they produce over a wide area on the eastern side of the basin. Although the drilling is concentrated in Morgan, Adams, Washington, and Logan counties, the trend extends into western Nebraska and southeastern Wyoming.

Recent discoveries indicate that development drilling in this Adena-Little Beaver area will continue at a high level during the next year. Many companies are faced with expiring leases and must drill or drop their acreage. As a consequence, wildcatting efforts may even increase.

Most contractors use jacknife rigs capable of going to 6,000 ft. Very few major drilling problems are encountered in field wells and mud costs are low.

Oil companies operating in the basin have offices at Fort Morgan or Brush, the main supply centers; Sterling, Colo. and Sidney, Neb., are also supply centers.

Moving of equipment is not a difficult problem except in wet weather. The terrain is relatively flat and the secondary roads passable. Occasional severe snowstorms slow down operations in the winter, but the weather is not a serious problem.

Average field wells require 8 to 10 days and six to eight rock bits to the "J" sand at 5,500 ft. During recent months there has been an increase in the use of jet bits and contractors are currently evaluating penetration rates using this type of bit.

Slim-hole rigs capable of going to 5,000-6,000 ft. are now being used for wildcat tests by some oil companies. These rigs have the advantage over the conventional type in ease of moving from location to location and in being cheaper to operate. Early results with these rigs did not compare favorably with conventional drilling because the time required to drill a 5,000-ft. hole was nearly double (13 days). More efficient drilling practices using these slim-hole rigs have cut the time in half. Slim-hole rigs now can drill as rapidly as conventional rigs, and the time to rig up, tear down, and move is considerably less.

Black Hollow . . . On the west side of the Denver-Julesburg basin, operators are drilling deep tests (9,000 ft.) to the Lyons sandstone, pay horizon at Black Hollow field, 70 miles north of Denver. Here the problems are entirely different from those in the Adena-Little Beaver area. Heavier rigs are needed and footage prices are higher.

Interest in the mountain side of the

basin is increasing and more holes will be drilled.

Crooked holes are a problem on the west side of the Denver-Julesburg basin. A recent test at Horse Creek field, Laramie County, Wyoming, recorded a maximum deviation of 7°.

On the southwest side of the basin, one contractor needed only 36 net days to reach the Dakota at 9,600 ft. Below this point digging was tough with an additional 30 days required to get the remaining 1,200 ft. to the Lyons. Total time on this hole was 88 days with 66.8 net days to total depth of 10,807 ft.

Powder River Basin

Primary drilling objective in the Powder River basin is the Newcastle sand in Weston and Niobrara counties found at 6,300 to 7,500 ft. Completions in this area account for one half of the total Wyoming activity. Although a few major companies are interested, most of the drilling is done by independents such as L. M. York, Voss Oil Co., R. L. Manning, Jr., and True & Brown.

Low mud costs . . . Drilling and completion practices in the area are fairly uniform and most wells are fractured. Penetration rates are faster than in other areas of Wyoming and drilling problems are not of major importance. Lost circulation in the Wall Creek sand gives the most trouble and occasionally mud bills run as high as $3,800 as compared to an average bill of $500.

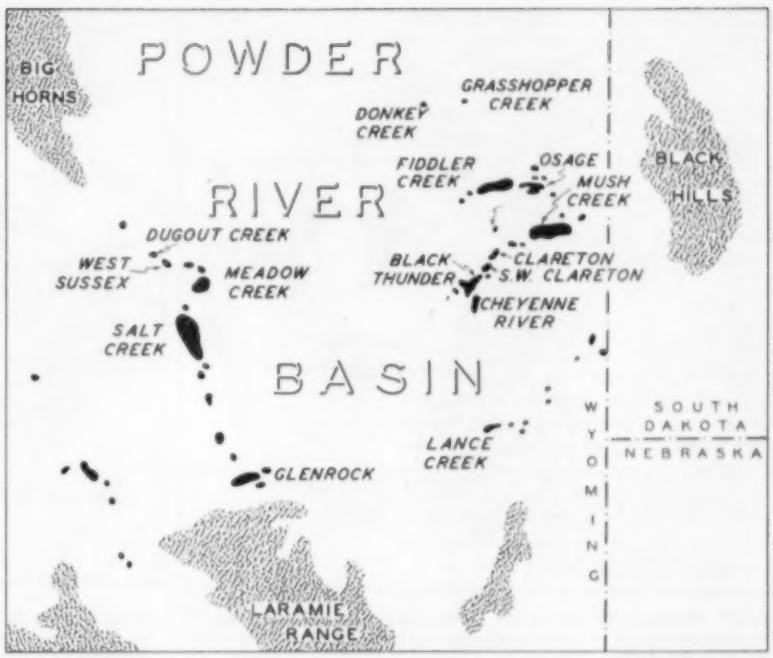
Wells in the 5,800-6,800 ft. bracket require about 11-15 net days to drill and the deeper wells take about 15 days to 6,800 to 7,200 ft. Average wells require 15 to 16 rock bits. Although the digging is not as fast as in the Denver-Julesburg basin, it is considered faster and easier than in the other Wyoming basins.

Water is a problem in the Newcastle trend and 160 to 300-ft. wells are necessary to insure a supply. Even this is not dependable and several truckers transport water from the Cheyenne River to the development wells, a distance of 15 miles.

Customary practice is to drill through the pay sand, set pipe, and move the rotary rig to a new location. Nearly all completions are with cable tools and fracturing is a standard procedure.

Only a few wells are active in the southeastern part of the Powder River basin in the vicinity of Lance Creek.

Glenrock . . . This field is still of current interest and several development wells are being drilled, although the boom is over. Typical wells on this trend are drilled in 35 to 40 days to 7,100 ft.

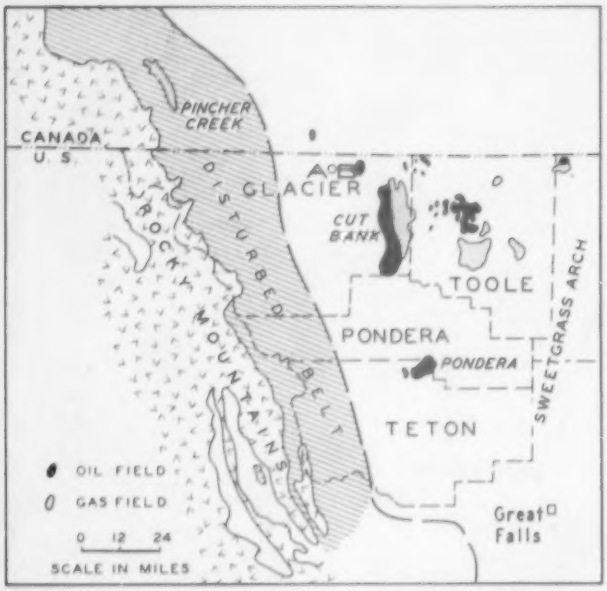


Few drilling problems are present along the Newcastle trend of Weston County, Wyoming, in the Clareton-Cheyenne River area.

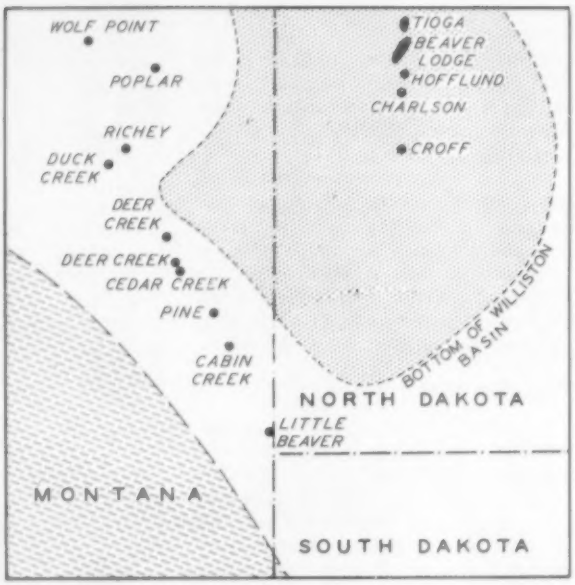
Salt Creek and West Salt Creek are enjoying renewed activity with the Wall Creek sand as the new reservoir.

Big Horn basin . . . Development drilling in the Big Horn basin is confined to the older producing fields for the most part with deeper pays the main objective or shallow sands that fracturing has made economic.

Drilling conditions vary considerably in the Big Horn basin, even on the field wells. Hole deviation is caused by steeply dipping beds and gives considerable trouble.



Recent discoveries (A and B on above map) mean more drilling for the Sweetgrass arch of northwestern Montana. Few deep tests have been drilled in this area.



Wells to 8,500 ft. in the Beaver Lodge-Tioga area are now drilled in 30-35 days. Most contracts in the Williston basin are on a day-work basis rather than on a footage rate.

Drilling conditions are highly variable from field to field and even within the producing fields. Most of the fields are elongate, sharply folded anticlines and depth to the reservoir depends upon structural position. Steep dips are common and it is difficult to keep holes straight. Considerable time is lost on many wells because of this problem.

Wind River basin . . . Madison production at Beaver Creek has focused attention on this zone. It appears probable that deep tests will be drilled on many of the known structures seeking this reservoir. Drilling problems are similar to those in the Big Horn basin and are highly variable.

Hanna basin . . . Muddy sand production at South Big Medicine Bow has sparked development in this small structural basin, although there are few wells drilling. In this field, hole deviation is the main drilling problem and contractors are held to a maximum deviation of 5°. Rugged terrain is characteristic of the area, but most roads are passable except in extremely bad weather. The discovery well in the field required 59 days to complete, including rigging up and tearing down.

Sweetgrass arch . . . Two recent oilers in northwestern Montana indicate that drilling activity on the Sweetgrass arch is on the upswing. This area has had few deep tests and most of the wells have not penetrated through the Madison limestone. Kevin-Sunburst and Cut Bank, largest fields in the area, are old and almost no drilling is being done in these fields. Operators are attracted to this area because of the relatively shallow drilling of 4,000 to 6,000 ft. as compared to 8,000 to 10,000 ft. in the Williston basin.

In contrast with other areas in Wyoming and Montana, steep dips are absent and crooked holes are not a serious problem.

Williston Basin

Development drilling in the Williston basin is confined to three trends: Poplar, Beaver Lodge-Tioga, and the Cedar Creek anticline. Limestone reservoirs are the main pay zones and are found at depths ranging from 8,000 to 9,200 ft.

Weather is the most serious problem affecting drilling operations in the Williston basin. Severe blizzards and subzero weather make winter operations hazardous and it is necessary to winterize all rigs.

Beaver Lodge-Tioga . . . Main problems in these fields are sloughing shales and drilling in the pre-Cretaceous salt and anhydrite sections.

Surface casing is usually set about 600 ft. after drilling through the glacial drift and Tertiary rocks. The Cretaceous sands and shales are drilled using a native mud; normal mud weight is 10 lb. per gal. Large amounts of water are needed to combat the Cretaceous shales that form solids in the mud. In order to reduce mud weights in the shale section, special additives are used to thin the mud and to produce greater settling of the cuttings in the mud pits.

Salt, gypsum, and anhydrite below 5,900 ft. force contractors to convert to a salt-saturated mud at the top of the Spearfish formation in order to drill through the evaporite sections. Other chemicals are added to these muds for viscosity and filter-loss control.

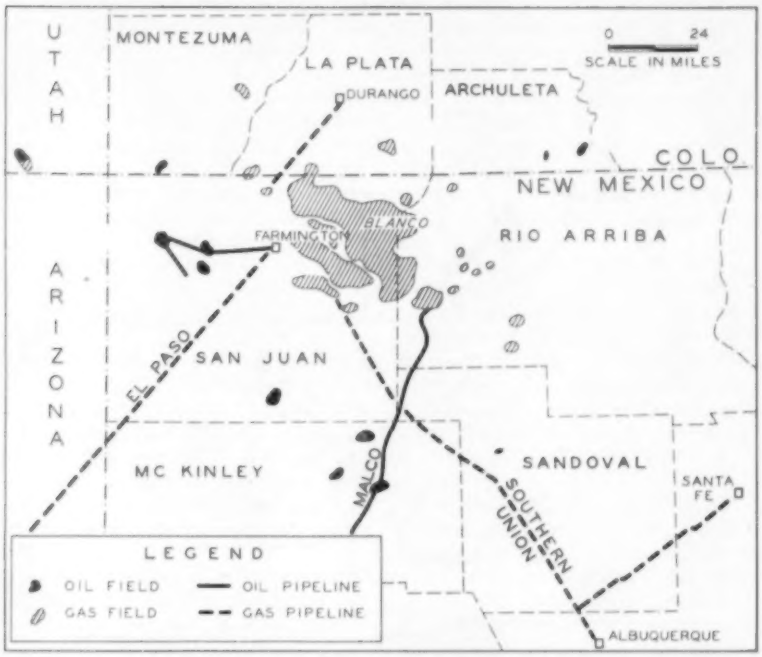
Contractors add 20 to 60 bbl. of crude oil to the mud while drilling through Charles formation found at about 8,000 ft. in Beaver Lodge field.

Formation pressures are normal in the Beaver Lodge-Tioga area. Lost circulation in the porous limestones does occur, but it is not a serious problem.

Cedar Creek anticline . . . Seven fields in southeastern Montana produce along this 100-mile trend from pre-Mississippian limestones. Mud problems are similar to those at Beaver Lodge and Tioga.

During early development work operators required considerable coring and testing in field wells. Now, however, this is held to a minimum and as a consequence, drilling time on field wells has been cut nearly in half. Early wells on the trend required 100 days to drill, but now wells are completed in less than 50 days to 8,500-9,100 ft.

Normal practice is to run 10¾-in. surface casing and 5½-in. oil string. The pay string is set on bottom and operators complete the well through perforations. Shell Oil Co. permits a maximum bore hole deviation of 6°



Development work is increasing in the San Juan basin, now that a pipeline outlet to the Pacific Northwest is assured. Drilling with gas is standard practice in completing field and wildcat wells.

from 6,000 to total depth of about 9,000 ft.

Contractors active on this trend include R. L. Manning, Zack Brooks, Pioneer Drilling Co., Brinkerhoff Drilling Co., J. D. Sprecker, Hewitt Gulock, Loffland Brothers Co., and H. & H. Drilling Co.

Mud program . . . In the Glendive area, two different types of drilling fluids are required for the two major, distinct lithologies encountered. The upper group ranging from surface to about 5,000 ft., is comprised of shale with some sandstone which is accompanied by considerable bentonite; this requires the use of a fresh-water mud. The lower group, from 5,000 ft. to total depth, consists of a limestone and evaporite section and requires a salt-saturated mud.

Upper section . . . In this interval about 115 lb. of bentonite is used per day, or a total of about 1,600 lb. on a 14-day period. In addition, 295 lb. of caustic (21 lb. per day) and 825 lb. of quebracho (59 lb. per day) are required.

When crews start up under surface pipe, a 9.2-lb. mud is carried with a viscosity of about 43 seconds A.P.I. When the Newcastle section of the Cretaceous is encountered, mud weight is raised to 10.0 lb. per gal. and viscosity held at about 40 to 43 seconds A.P.I.

Lower section . . . The lower group, which extends from 5,000 ft. down through the Ordovician Red River dolomite, consists mainly of limestone with considerable exaporites and some sandstone and shale. Anhydrite and gypsum are found in the lower section; salt in large quantities is present in the Triassic Spearfish formation, the Mississippian Charles formation, and the Devonian section. To condition drilling fluids for penetration through the evaporites, the mud system is converted to a salt-saturated mud at the top of the Triassic Piper lime just above the Spearfish formation.

San Juan Basin

An active drilling program to develop the gas reserves of the San Juan basin is now under way. This campaign has been stimulated by the assurance of a pipeline to the Pacific Northwest, the largest undeveloped gas market in the United States.

Pacific Northwest Pipeline Corp. plans a $23,000,000 drilling program and other companies active in the area are expected to step up their development work.

Major producing zone in this basin is the Mesaverde formation encountered at an average depth of 5,000 ft. and Blanco is the largest field.

Lost circulation was a very serious problem during the early development of the San Juan basin, and it became almost impossible to drill through the Mesaverde with ordinary muds without excessive drilling costs. In addition, the plugging action of the mud curtailed the gas production. The bentonitic clay in the Mesaverde further cut down the gas output of the wells, because this clay swells when in contact with water and reduces the formation porosity.

Contractors tried cable-tool drilling without much success because completions were slow and fishing jobs numerous. These wells required 5 to 8 weeks to drill the 800-ft. Mesaverde section.

Gas replaces mud . . . Gas drilling has been the life saver for the San Juan basin. This technique was first introduced in 1951 and now is the accepted method of drilling through the gas sands. Well costs have been reduced about $20,000 per well by drilling with gas, and completion times cut from 4 to 6 weeks per well. Over 600 wells have been drilled in the San Juan basin with this method.

Contractors normally drill to the top of the pay zone using conventional rotary tools and gel-base mud. After the casing is run, the Mesaverde is drilled using gas as the circulating medium instead of mud.

Gas drilling has enabled contractors to mill windows in casing and set whipstocks, to drill drain holes, and to fish.

Fire is the greatest danger when drilling with gas, but proper instruction of personnel reduces this to a minimum. Operators recommend that contractors change drilling-head rubbers, inject water into the engine exhausts, and lay flow lines at least 300 ft. from the rig and burn the returning gas. Several fires in the San Juan basin have been traced directly to carelessness and none of these occurred during actual drilling operations.

Large volumes of gas are not a hazardous problem, as El Paso Natural Gas Co. has drilled in wells flowing 36 M.c.f. natural and other companies have completed wells that gaged 55 M.c.f. of gas per day.

Few tool-joint failures have occured due to sandblasting and flush-joint or double-streamline drill pipe holds sandblasting effects to a minimum.

Advantages to gas drilling are:

1. Faster drilling rates and shorter cleanout time. Drilling rates have been stepped up 85 per cent and cleanout time reduced considerably with an estimated savings in well costs of $20,000 per well.

2. Eliminating the contamination of the producing zones by contact with water-based muds.

Drilling techniques and equipment . . . High-pressure drilling with gas pressure averaging 400 psi. gets the best results, although pressures may range from 250 to 450 psi. Drilling with

pressures below 250 psi. does not give satisfactory drilling rates. In the San Juan basin, contractors ordinarily use about 20,000 lb. on the bit and a rotary speed of 80 r.p.m. to drill an 8¾-in. hole.

Conversion of conventional rotary equipment to gas drilling is a relatively easy matter. The well-head equipment is similar to that on a normal well, although a rotating head is added to the standard blowout equipment to prevent the gas from escaping around the kelly. A simple piping setup is used for the gas supply. The exhaust gas is discharged through a 6-in. pipe, 300 ft. from the well, and burned.

Connections are made by shutting off the gas supply and allowing the pressure in the drill pipe to discharge through the exhaust pipe. A float valve in the drill pipe above the bit prevents the formation gas from escaping through the drill pipe while making connections or a trip.

Safety precautions . . . Operators strongly recommend that contractors pursue an aggressive and standard safety program. Blowout equipment should be checked every tour, as these preventers are of extreme importance when high-pressure gas is encountered.

No smoking on the rig floor is a cardinal rule to prevent fires. Many companies will not permit personnel to carry cigarettes or matches onto the rig and even designate a smoking area for the crew.

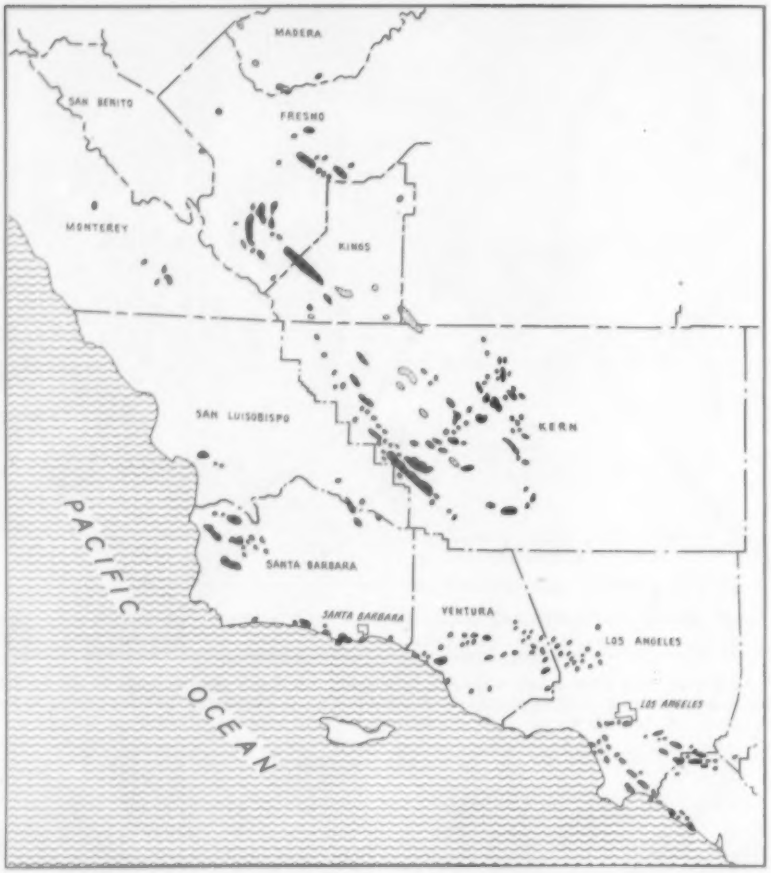
Outlook

Oil provinces usually pass through three distinct phases during their exploration, drilling, and oil-production history. First is the early stage when prospects are easy to find and the success ratio on wildcats is high. During this period the rapid development of oil fields is often retarded by the lack of adequate pipeline outlets and drilling problems are numerous and varied.

The second phase is marked by a gradual change to an orderly development program as well control increases. Prospects are harder to find, but they are still numerous. It is in this period that seismic work is used to best advantage. Drilling problems still occur, but can usually be anticipated.

The final phase occurs when well control is plentiful and drilling becomes a routine procedure. Subsurface control is used to excellent advantage in locating sand pinchouts and other types of stratigraphic traps.

Current developments clearly indicate that the Rocky Mountain area is still in the early-development phase and that it will continue to play a major role in the drilling industry for the next several years.



California drilling is concentrated in the San Joaquin Valley, the Santa Barbara-Ventura region, and around Los Angeles. The state's poor discovery record of the past 4 years has seriously retarded development drilling.

California Footage Record Holds But Completions May Drop

by D. H. Stormont
West Coast District Editor

CALIFORNIA, after several years of progressively higher drilling activity, will probably complete fewer wells this year but total footage may continue the upward trend.

A substantial portion of the drop in completions, expected to be about 200 fewer than last year based on 8-month figures, can be traced directly to the state's poor discovery record of the past 4 years.

Another contributing cause is the over-all excess of petroleum on the West Coast, brought about by imports and loss of markets to Canadian and Rocky Mountain crudes.

Aside from some heavy-oil reservoirs, few California fields contain an appreciable number of undrilled locations. Notable exceptions include Wilmington, Ventura Avenue, and Buena Vista Hills. Elk Hills likewise contains numerous undrilled locations but all development there has been suspended by the Navy Department.

A good indication of the shortage of desirable drilling locations is offered by the caliber of this year's completions. According to monthly reports compiled by the Conservation Committee of California, initial production of oil wells completed during the first half of this year were 15 per cent below last year's average. This year's wells averaged 99

bbl. daily as compared with 114 last year. During June the average well completed had an initial production of only 93 bbl. daily.

Not only is this year's crop of oil wells fewer and less productive but they also are deeper. During the first 8 months of this year, 7,291,700 ft. of hole was drilled. This compared with a total footage, field wells and wildcats, of 7,462,300 ft. during the like period last year. Average depth of this year's completion, 4,650 ft., compared with a 4,350-ft. average for the first 8 months of 1953.

Further study of this year's activity shows that bulk of the drilling decline occurred in San Joaquin Valley. Kern County alone had 130 fewer completions at the close of 8 months. The near-future outlook in the valley area and that in the coastal region and Los Angeles basin area are outlined below.

San Joaquin Valley . . . Suspension of development at Elk Hills during the second half of the year, coupled with a letdown in drilling in nearly all other San Joaquin Valley fields, has brought the number of rigs operating in that area to the lowest point since early 1951.

Recent discoveries will provide some locations but there appeared to be little which would make for a substantial upturn in activity. Most active field in the whole valley during early September was the old Midway-Sunset area. There seven rigs were at work. In the Guijarral Hills area where two prolific discoveries were recorded in the past year, four rigs were at work where 3 months previous there were eight. The Eocene find recorded at Wheeler Ridge 2½ years ago by Richfield Oil Corp. apparently has been almost fully developed, as have most of the field's shallower Miocene pays.

An interesting development in this region has been at Guijarral Hills in the Coalinga area. There Standard Oil Co. of California and Union Oil Co. have been the principal developers of an 8,500-ft. Leda sand (Oligocene) pool discovered by the latter early this year.

In this drilling, which is more or less typical of other San Joaquin fields of similar depth, 11¾-in. casing is set at approximately 500 ft. with 300 sacks of cement. Seven-inch casing generally is set (with 1,000 sacks) on top of the pay at about 8,700-ft. and a 5½-in. liner run to total depth. In addition to the 15-in. bit consumed in the upper hole, usually some 25 regular 10⅝-in. rock bits are required. Total time from spudding to completion is in the range of 25 to 30 days.

No particular drilling problem is encountered so that a relatively simple mud program is followed. In drilling down to the casing point, a clay-base mud weighing about 75 lb. per cu. ft. and of 45 to 50 seconds viscosity is used. In drilling the pay section the weight is stepped up to 77-80 lb. per cu. ft. and the viscosity to a range of 60 to 70 seconds. More recent wells have been completed in the range of 25 to 30 days, total time from spudding to completion.

One of the valley's greatest backlogs of undrilled locations is in Buena Vista field. There 36 producers have been completed along a 7½-mile trend to prove, or semiprove, an area of about 4,000 acres. The fractured-shale reservoir has a tendency to be somewhat spotty but it would appear that possibly as many as 150 more wells will be drilled.

Principal operators in the 3,500 to 4,500-ft. pool, known as the Antelope fractured shale, are California Standard and Honolulu Oil Corp. After extent of the pool had been established by primary wells at the center of each 160-acre drilling unit, these two operators (and Murvale Oil Co., a Standard subsidiary) suspended drilling pending unitization. These operators have agreed upon a unit plan, with Honolulu as operator, and when approved by the Navy Department they will resume development.

Santa Clara Valley . . . Drilling activity in the coastal region, which likewise is requiring fewer rigs than at this time a year ago, is concentrated in the Ventura Avenue-San Miguelito area. There some 20 to 25 rigs are continually at work for Shell Oil Co., Tide Water Associated Oil Co., Continental Oil Co., and others. Drilling principally is directed to the D-6, D-7, and D-8 zones at an average depth of about 11,500 ft.

Rugged terrain along the coast causes transportation problems, especially on wildcat locations such as this.

Extension of Ventura's deeper pays into San Miguelito field touched off a competitive drilling situation between Shell and Continental. The zones have been developed in the vicinity of the common boundary so that in recent months drilling has tended to wane.

At Fillmore, about 20 miles east, California Standard has two rigs at work on an early-1954 discovery which is of significance. At Oxnard, south of Ventura, Standard likewise has four rigs at work in a lower Sespe pool which could be of considerable importance.

The Fillmore find, a 600-bbl. producer of 27°-gravity crude, was in an upper Pliocene sand at 14,170-14,235 ft. The original hole found only small shows, but sufficient to cause the hole to be plugged to 13,000 ft. and redrilled to a bottom-hole location 100 ft. away. This test found gas and condensate. Thus after setting protective casing to 11,008 ft., hole was deviated about 1,000 ft. south, where the well was completed at a total cost of $750,000.

This region accounts for a good portion of the state's below-15°-gravity crude output, and has more than its share of undrilled locations. The current excess of low-gravity crudes, evidenced by the fact 15,000 bbl. of such crudes is shut in, is having its effect on drilling in several fields. For example, probably more than 100 new wells eventually will be drilled in the 40-well Guadalupe field. But Union Oil Co., the field's sole operator, only occasionally adds a new well.

Los Angeles Basin . . . Until additional development starts in Wilmington field, or in submerged lands offshore from the city of Long Beach, drilling is expected to remain somewhat spotty. This famous field, California's largest, has been the basin's most active field for years. The current lag in drilling there has not been offset by activity associated with new finds.

Since much of the activity in this region is in or around cities and towns, slant-hole drilling more and more is becoming a characteristic technique. Widely practiced at Wilmington, Huntington Beach, and Sansinena, controlled direction drilling is making possible the development of two new discoveries, the Bandini and Beverly fields.

Activity in Sansinena field, and in other pools along the Whittier fault trend, has tended to hold steady in recent months. Union has four rigs drilling from islands at Sansinena, three rigs are at work in Whittier, and a like number at Brea-Olinda.

Texas Drilling Up 10 Per Cent Over '53

. . . in spite of fewer active tools in state

TEXAS is headed for another banner drilling year in spite of the alarmists and Calamity Janes who are worried about the number of rigs "turning to the right".

Well completions exceed last year's figures by 6 per cent, although the total number of rotary tools operating is about 5 per cent less than the 1953 figure. The total footage drilled in 1954 in the first 6 months is up 3,200,000 ft. over the 1953 figure; this represents an 8 per cent increase.

Drilling in Texas affords a variety of conditions ranging from the grassroots production in the Wichita Falls area to the 14,500-ft. Ellenburger wells in West Texas. Drilling problems as a consequence run the gamut from blowouts to heaving shale, from fast digging of 1,000-5,000 ft. per day along the Gulf Coast to the slow drilling through chert in the Permian basin where penetration rates may be less than 50 ft. per day.

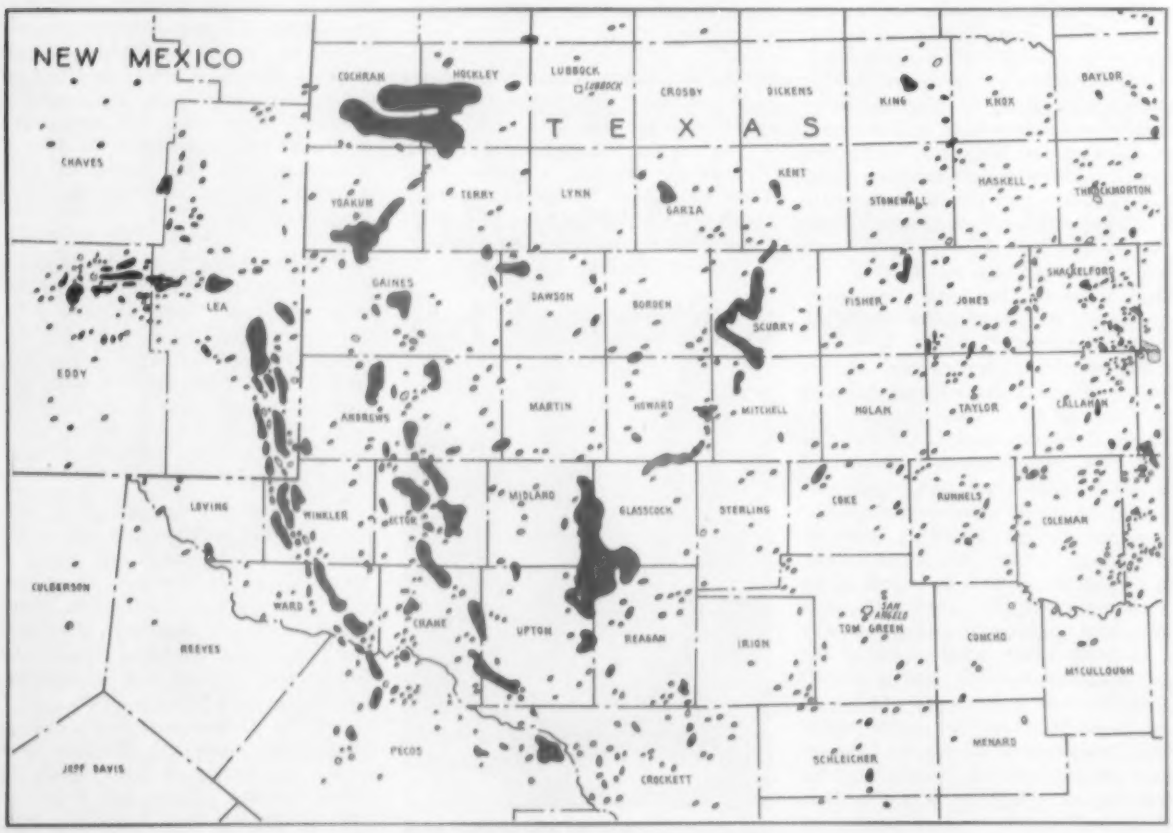
Aggressive oil companies are pursuing an intensive exploration program in an effort to increase their reserves. Seismic surveys alone are not the answer, although 222 crews are now active in the state. The bit is the only sure way to find production from stratigraphic traps, flank production, and deeper pay zones. In many areas, these plays are now assuming the dominant role.

Finding new oil is a must for prudent operators, and few large untested seismic anomalies exist. As a consequence, more holes will be drilled on stratigraphic plays in the never-ending search for reserves.

Texas Panhandle . . . This part of the Hugoton embayment is one of the hottest areas in Texas, because the 1954 wildcat record is one of the best in the history of the Panhandle. Production below the Permian pays of the old gas field has stimulated an active drilling program and completions are up 20 per cent over a year ago.

West Texas . . . Deep Ellenburger production dominates the West Texas drilling picture with pay zones below 13,000 ft. at Headlee, Virey, Pegasus, and Midland Farms. Discovery of Ellenburger oil on the Dora Roberts ranch near Midland has touched off a deep-drilling boom and 14 rigs are active on this trend.

Wolfcamp production at 8,000 to 9,500 ft. at Nolley, Wemac, and Parker marks the beginning of an aggressive search for this reservoir. Activity in the Spraberry trend is at a low ebb, and the future is dim. Operators consider the zone may be economic on 80 and 160-acre spacing, but are not pursuing an



Deep Ellenburger production in Andrews and Midland counties is developing into a play of major proportions and insures a bright future for West Texas.

active development program. Interest in the trend, however, has revived somewhat due to the indicated success of the large-scale fracture treatments and 12-15 rigs are kept busy.

Present outlook is for West Texas drilling to continue at about the same level. Deep production with expensive development wells has prevented small operators from entering the current plays. As a result, contractors deal with major companies such as Stanolind Oil & Gas Co., Phillips Petroleum Co., Humble Oil & Refining Co., Gulf Oil Corp., and well-established independents like Ralph Lowe, Honolulu Oil Corp., and Husky Oil Co.

West Central Texas . . . Cambrian sandstone production with its high reserves has held the interest of operators in Coke and Nolan counties. Activity on this trend, however, is leveling off as oil companies attempt to evaluate their acreage and locate new producing areas. Strawn sand development at Jameson in northwest Coke County keeps 15 rigs active

Drilling in West Central Texas is confined to 6,000 to 8,000-ft. tests, even on wildcats, and contrasts sharply with that in the Permian basin. Pennsylvanian sands and limes, the Ellenburger, and the Cambrian are the principal pay zones and small operators, as well as independents and majors, are active. Seismic work is not always reliable and operators rely heavily on wildcats and farmouts to test their prospects.

West Central Texas is a young producing area; most of the important fields have been discovered and developed during the last 10 years. Oil companies are expected to maintain active drilling programs in this region because of the multiple pay zones, relatively shallow, inexpensive drilling, and the successful discovery record of the past few years.

North Texas . . . Shallow drilling accounts for over 80 per cent of the activity in North Texas and both cable tools and rotaries are used in this old producing area. More wells are completed in Districts 7-B and 9 than in any other Railroad Commission district in Texas; Oklahoma is the only oil-producing state that surpasses North Texas in the number of completions.

Water flooding and fracturing have revived drilling in North Texas and Pennsylvanian sands are the primary objectives. During the first 7 months of 1954 there have been over 3,900 completions, with most of these falling in the 5,000-ft.-or-less category. Grayson and Cooke counties, by contrast with the rest of the area, are deep-drilling provinces with 8,000 to 10,000-ft. wells commonplace.

Shallow pays have attracted independents and small operators to North Texas, and only a few major companies are now active. Wildcatting is reasonably successful with about 20 per cent of the tests completed as oilers. Drilling is spread over a large area, rather than concentrated in a few fields or along major trends.

North Texas activity is comparable to north-central and northeastern Oklahoma. In all of these areas, locally important drilling booms are under way, because operators are developing marginal production, made economic through fracturing.

East Texas . . . Development drilling in East Texas is concentrated on the flanks of the Sabine uplift in Harrison, Panola, Anderson, and Cherokee counties.

Carthage, although an old field, is still one of the most active in the area with Pettit gas production the main objective. This zone also produces at Bethany and Woodlawn and both these fields have several rigs operating.

Hottest field in East Texas is Neches with 10 to 15 rigs currently in operation, developing sub-Clarksville and Woodbine production at 4,800-5,000 ft. Humble is the major operator in the field, although Sun Oil Co. and The Texas Co. have holdings.

Wildcatting in East Texas is aimed at developing deeper production in and around the old producing areas. The record for 1954 has been only moderately successful with 1 producer for every 11 dry holes. Prospects of another Neches, however, have held operators in the area and independents and majors are active in the current drilling.

West Texas Drilling

Competition is keen as contractors scramble to keep rigs busy in West Texas.

Footage prices and day rates have decreased 10-20 per cent during the past year. The number of days required to drill wells has also declined so that the over-all cost to the oil companies has been reduced substantially. Some contractors are faced with payments on their drilling equipment and submit low bids with no prospect of profit just to keep up the monthly installments. Other less-prudent drillers are submitting abnormally low bids by failing to consider normal depreciation of their rigs. In spite of the competition, most contractors feel that prices will soon stabilize and that more efficient drilling is one answer to the present problem.

Deep production . . . Ellenburger production at 12,000 to 14,500 ft. holds the spotlight in West Texas and over 63 rigs are now busy in the principal fields.

Problems in drilling in these fields include lost circulation, salt sections, crooked holes, slow digging through chert, occasional blowouts, and drill-pipe corrosion, to name only a few. Wells are punched down in record time and contractors now regard these 13,000 and 14,000-ft. holes as every-day accomplishments.

Wells in the 12,000-ft. class require 70 to 106 days to drill and those below 13,000 ft. take 110 to 150 days, depending upon local conditions. Footage rates on these deep tests range from $9.25 to $11.00 per ft. On many wells contracts are let on a footage rate to the top of the Devonian or some other convenient marker and then wells are drilled on a day-rate basis below this depth. Some of the deep-drilling day rates are on a sliding scale from 11,000 ft. to total depth. Rates with drill pipe start at $800 per day and range up to $1,175-$1,200 depending upon depth and field. Normal drill-pipe rental is about 1½ cents per foot or $100 per day.

Drilling problems . . . The Permian evaporite and salt section has forced operators to use an intermediate or salt string that is usually set between 4,300 and 5,300 ft. This section must be drilled with a salt-saturated mud, because this type of mud eliminates the large cavities that would normally form as the salt dissolved in a fresh-water mud. Recent instances of collapsed casing in the Williston basin have clearly shown the need for these precautions in drilling through the salt.

Lost circulation does occur, especially in the San Andres, at 5,000-6,000 ft., and in the porous pre-Permian limestones. Conventional lost-circulation material usually is successful in combating this problem.

Aerated mud has been used with success in Puckett field of Pecos County; this method has several advantages over conventional drilling muds.

Chert is a headache on wildcat and field wells, but the "chert clause" is usually written into wildcat contracts only. This clause provides for operators to pay day rates after 24 hours of drilling in chert. These zones can normally be anticipated in field wells and taken into consideration when the contractors submit their beds. Chert bits are successful in stepping up penetration rates through these tough-drilling zones.

Penetration rates . . . Deep holes are

now drilled in less than one-third the time required a few years ago. This increase is due to the use of bigger drill collars and increased weight on the bits; chert and jet bits; and the use of water as a drilling fluid. Many contractors, however, feel that it is too difficult to wash over these large collars during fishing jobs; as a result, the use of smaller collars and stabilizers is still popular. Experience in other areas has proved that it is possible to recover these oversize collars, even on difficult fishing jobs.

Although jet bits are used, the jetting action in many cases is very low or negligible because of improper pump setups or insufficient pressure.

Corrosion . . . Salt water aggravates corrosion and shortens the normal life of drill pipe and other equipment. Many contractors now inspect their drill pipe regularly to check for flaws and corrosion. Defective pipe is either rejected or used at shallow depths only. This inspection helps eliminate costly fishing jobs due to drill pipe parting. No universal panacea is available to combat corrosion, but contractors have tried various types of protective coating and cathodic protection.

Rapid corrosion makes it difficult for contractors to estimate drill-pipe life and to figure depreciation on their equipment.

Wolfcamp play . . . Several fields are producing from the Wolfcamp limestone at 8,000-9,500 ft. and development of this zone will continue. Drilling problems on this trend are not as serious as in the deeper Ellenburger play. Drilling times are considerably lower with 8,600-ft. wells at Andrews requiring only 45 days.

Casing programs and drilling practices are similar in many respects to those in the deep fields. Most operators set a salt string, drill through the pay, set pipe on bottom, and complete the well through perforations. Lost circulation and crooked holes give some trouble; fortunately the pay zone occurs above the troublesome chert so that it is not a problem.

Spraberry trend . . . Drilling activity on the Spraberry has revived somewhat, but is at a standstill compared to the lush days of 1952.

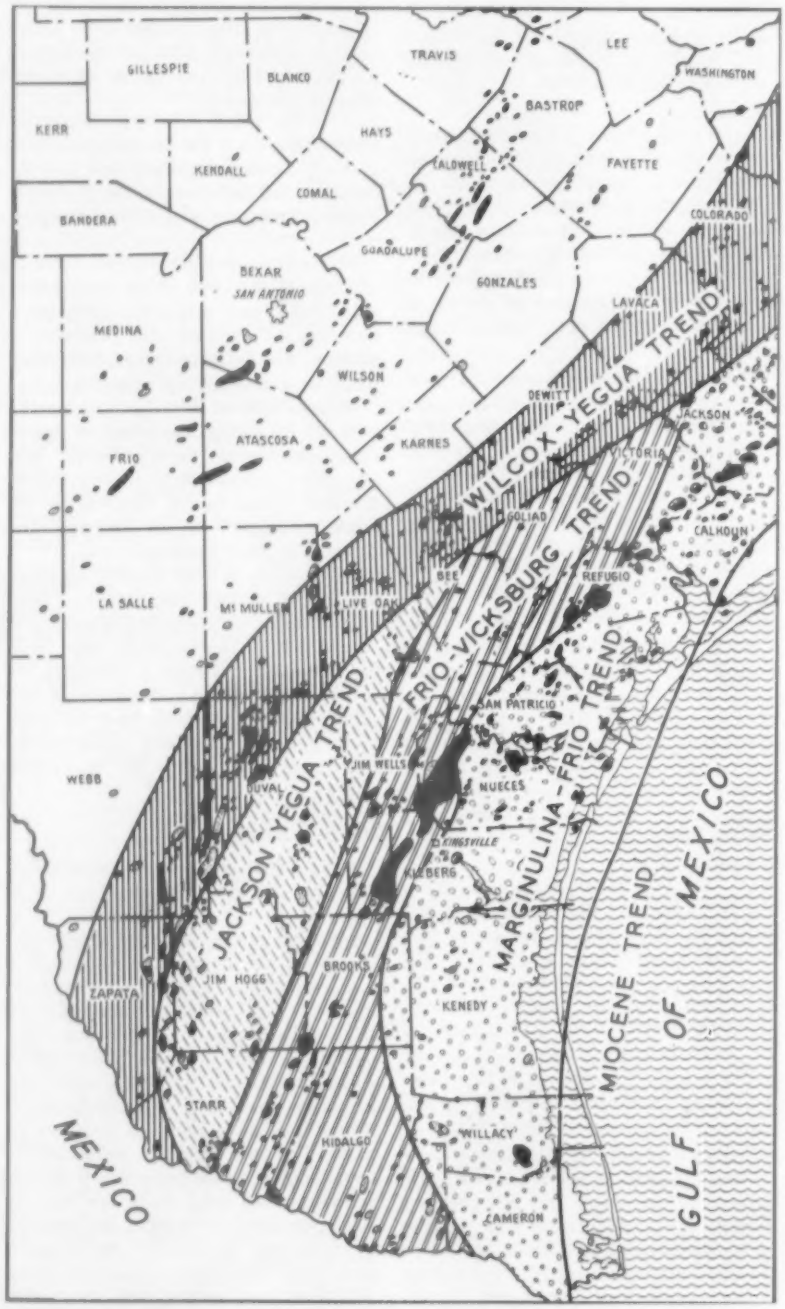
There are now almost as many casing and completion programs on the trend as there are operators, according to one service company. Many operators set pipe through the lower Spraberry and fracture the upper and lower pay zones, using large volumes of sand-oil under high pressures. Contractors use salt-saturated muds to get through the Permian evaporites and set a salt string, usually around 3,500 ft.

Texas Gulf Coast

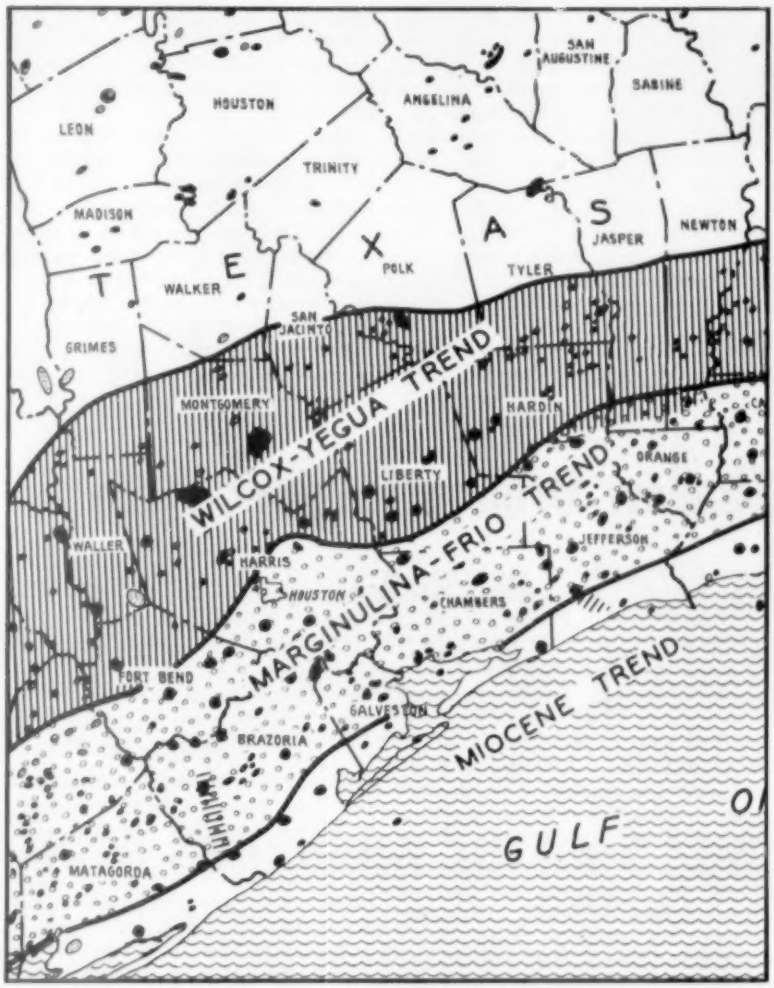
Fast drilling on the Texas Gulf Coast has kept footage prices down compared to other areas.

Permanent-type completions, first introduced on the Gulf Coast, are becoming more popular because they cut down on well costs and are proving highly satisfactory, especially on the deep wells. Contractors are expected to drill more slim holes in the future as permanent-type completions can be made in these small-diameter holes.

Jet bits are another reason for the fast drilling on the Gulf Coast. The use of jets has upped drilling rates as much as 100 per cent in the shallow beds. Penetration rates of 200 ft. per hour are not unusual because of these bits and the added drilling power brought about by increasing the hy-



South Texas activity is concentrated along the known trends. The search for deeper production increases the drilling problems and well costs.



Jet bits and the use of permanent-type well completions have cut down the number of days required to drill wells along the Gulf Coast.

draulic horsepower. This higher pump horsepower has been accomplished by use of larger pumps, and compounding or paralleling present pump systems.

Lost-circulation and high-pressure zones force contractors to maintain proper mud programs. In some wells it is necessary to keep a mud balance of as little as ½ lb. per gallon to prevent the hole from either "sucking" or "blowing." Gas zones can change mud weights by 30 to 40 per cent. As a consequence, some contractors are using degassing systems to maintain the desired mud weight.

Lost-circulation difficulties can normally be stopped using conventional materials such as walnut hulls and granulated and fibrous materials. At times it is necessary to use cement plugs or resort to squeeze jobs with bentonite and diesel oil.

Depth to the producing zones is variable along the Texas Gulf Coast, but the trend is toward deep drilling. This means that contractors are faced with possible blowouts, lost circulation, salt-water flows, heaving shales, and similar problems that have plagued South Louisiana drilling. The use of degassing equipment and centrifuges to cut down on solids in the mud is becoming more widespread.

One service company now rents a centrifuge for removing solids from the drilling mud. This machine can even separate the original mud-making materials from the fluid. It is possible that these centrifuges will be used in the future to reclaim the drilling mud for use on the next hole. Contractors have been slow in adopting this machine because of its rental cost of $100 per day. Most mud bills are paid by the oil companies so there is no incentive for renting or buying these centrifuges. If operators were willing to pay for these machines, it is probable that their use in treating mud would become more widespread.

West-Central Texas Drilling

Shallow drilling to 6,000 to 7,000 ft. has attracted both independents and major companies to West Central Texas.

Drilling is relatively straightforward, although lost circulation in Pennsylvanian reefs and in the Ellenburger limestone can cause mud bills to skyrocket. These wells are the exception to the general rule. Crooked holes slow down the penetration rates and increase the drilling time on a well. Hole deviation is most noticeable on the flanks of the reefs where the steep dips accentuate the problem.

Principal pay zones are the Pennsylvanian sands and limestones, the Ellenburger, and the Cambrian. Most 6,000-ft. field wells require 25-30 days to drill and use about one bit per day. Contractors use rigs with jackknife masts, capable of going to 7,500 ft.

Multiple pay zones are common and many wells are dually completed. Most operators complete the wells through perforations, either acidizing or fracturing the pay zones, depending upon the nature of the reservoir.

Jameson (Strawn) field is one of the most active in West Central Texas today with 15 rigs running. Contractors drill 6,400-ft. wells in 28 days and use about 36 bits. Contract prices vary from $4.75 to $5.75 per ft., and day work rates average $650 with drill pipe and $600 without.

Drilling on the Cambrian trend in Coke and Nolan counties requires about 30-35 days to 6,000 ft.

North Texas Drilling

Shallow production has attracted independents to North Texas where Pennsylvanian sands produce over a broad region. Both fracturing and water flooding have rejuvenated this part of Texas.

Drilling is relatively easy and many field wells are punched down in less than a week. Both light rotary and cable tools are employed, although contractors use heavy-duty rotaries in the deeper drilling in Cooke and Grayson counties. In these deep holes, contractors run 1,000-2,000 ft. of surface casing to protect the fresh-water-bearing Trinity sands, because many towns rely on these zones for their water supply. In drilling below surface pipe, operators recommend a light mud, usually weighing less than 10 lb. per gal., in order to prevent lost circulation. Proper mud control is essential in drilling the deep Ellenburger tests in the Walnut Bend-Big Mineral area.

Apart from Cooke and Grayson counties, shallow wells encounter few problems in drilling to the Cisco, Can-

yon, and Strawn producing zones, and mud costs are low. West of Wichita Falls, the Permian evaporites can give trouble and makeup waters are badly contaminated with gypsum and salt.

North Texas is the most active Railroad Commission District in Texas, although it is an old area.

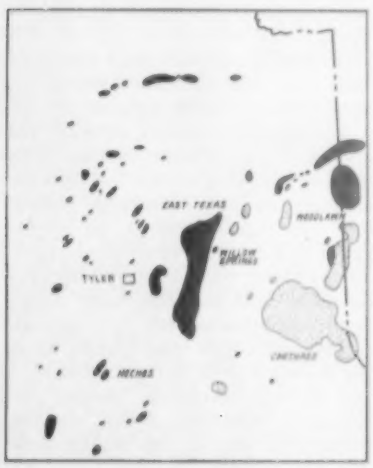
East Texas Drilling

Neches . . . Ideal conditions prevail at Neches field in East Texas for fast, easy drilling and 4,800-ft. wells are drilled in less than 2 weeks. Few drilling problems exist and some operators are using permanent-type completions. The oil string is cemented in two stages; some wells are dually completed in the Sub-Clarksville and Woodbine.

Panola County . . . Gas production at Carthage and Bethany from Lower Cretaceous limestones keeps 15-20 rigs running in this part of East Texas. This is another spot where easy digging has attracted both majors and independents.

Most wells are in the 6,000 to 7,000-ft. class and take only 5 weeks to drill and complete. Drilling programs are fairly standard with very little trouble encountered on these wells. Principal headache is the prevention of mud contamination from the anhydrite section; this is accomplished by any one of several methods:

1. Low-pH caustic-quebracho muds with barium carbonate added to remove the anhydrite chemically.
2. Low-pH natural muds with phosphates or soda ash added as control agents.
3. High-pH calcium-treated muds in which, once they are converted, the anhydrite has little or no effect.



East Texas drilling poses few problems, although contractors must prevent mud contamination while drilling through the Massive anhydrite.

Most contractors convert their mud just prior to penetrating the anhydrite zone, usually around 4,300-4,500 ft.

Locally lost circulation occurs in the Lower Cretaceous limestones and occasionally blowouts. Proper mud control, however, can overcome these two problems.

Drilling conditions at Woodlawn are very similar to those at Carthage because of the fairly uniform geological section that underlies much of East Texas.

Wildcatting . . . Deep drilling is becoming more popular in East Texas and more Cotton Valley and Smackover tests will be drilled. Drilling these wells is more of a problem than drilling in the Pettit and Woodbine areas, because depths to these zones range from 8,000-12,000 ft.

Mud control is important as some wells have required mud weights as high as 17 lb. per gallon to control the high pressures in the Cotton Valley and Smackover formations. Black shales in the Cotton Valley may cause the drill pipe to stick. The combination of these black shales and the deep evaporite section in the Buckner formation can play havoc with the mud and may require expensive chemical control and considerable water thinning.

Shallow Drilling Revives Activity In North Louisiana

ANNONA chalk production commands the interest of North Louisiana operators and at least one-third of Louisiana's total completions are from this zone in the old Caddo-Pine Island field. This is a favorite spot for small operators because of the shallow depth (1,500-1,600 ft.), and the very high percentage of producers.

Cotton Valley production is still important, but activity on this trend is declining. New fields will undoubtedly be discovered along the "fairway" between Hico-Knowles and Monroe, and in other areas where the sand limits have not yet been clearly defined, such as Midstates Oil Corp. "D" sand discovery in Bistineau field in late July.

Southern Arkansas needs some successful wildcats to step up the waning drilling activity. Exploration and drilling work is confined to "mopping up" operations such as localizing sand pinchouts and pin pointing small structures that were overlooked in the past.

Wilcox development in LaSalle, Catahoula, Concordia, and Tensas parishes continues at a fairly steady pace. These fields are usually small in areal extent, but reserves are large in the highly porous and permeable Wilcox sands. Difficulty in locating new fields on this trend has deterred many operators.

Caddo-Pine Island . . . Both rotary and cable tools are used in this play, and well costs are low. Fracturing has made the Annona chalk economic, although ultimate recoveries are not large. Completions often exceed 30 wells per week, and they are brought in for initial potentials of 20 to 30 bbl. of oil per day per well.

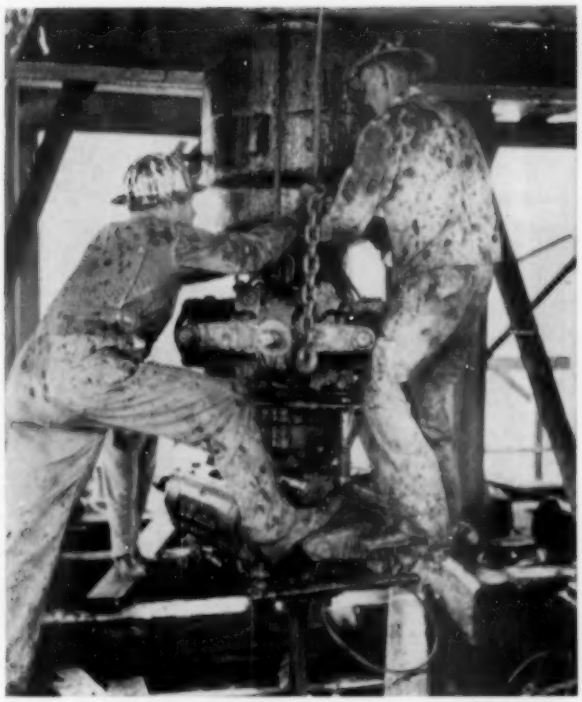
Customary practice is to fracture all chalk wells prior to completion and most operators set pipe on bottom. Many 1,600-ft. wells are completed in 3 days, using only one rock bit.

Cotton Valley trend . . . Activity on this highly profitable trend has definitely slowed down, compared to a few years ago, but it is still a favorite among major operators who are attempting to bolster their gas reserves in North Louisiana.

Bodcaw, "C", "D", and Vaughn sands are the main pay zones found at depths ranging from 8,000 to 10,000 ft. In Benton field, Sunray Oil Corp. sets 10¾-in. surface pipe at 1,500 ft. and the oil string on top of the Bodcaw sand at 8,130 ft., with completion in the open hole. Many operators set pipe through the pay zone and complete through perforations.

Well completions in North Louisiana are nearly double the 1953 figure because of the large number of Annona chalk wells drilled in the old Caddo-Pine Island field.

Swamps and bayous have forced contractors to use barge-mounted rigs and water transportation.



Adequate blowout protection is a must in South Louisiana because of the abnormally high-pressure zones in the Miocene sands.

South Louisiana Sure of Long-Term Drilling

Successful exploratory drilling and the large number of seismic crews active in South Louisiana give promise of a long-range development drilling program for the next several years, probably at the present level.

Wildcatting is the tipoff to an oil province's future and South Louisiana is in a class by itself with wildcats 48 per cent successful based on 106 discoveries and only 114 dry holes.

In the bayou country operations are scattered over a wide area, and most fields are being developed on an orderly drilling program with only a few rigs active in each field. This is in marked contrast to the West Texas drilling booms of the past on the Spraberry trend and the Scurry County reef play. From the contractor's viewpoint, the South Louisiana operations are more inviting, as the slow but steady development permits him to set up operations on a more permanent basis.

Even the oldest fields along the Louisiana Gulf Coast such as Jennings are still active; deeper pays in and on the flanks of these structures are the rule today. Weeks Island is typical of this sort of campaign with 4 rigs running. Oil production was established on this salt dome in 1945 and since then the field has produced nearly 50 million barrels of oil. "Old salt domes never die"; they just produce more oil.

Along the coast, Miocene sands with their high reserves are the main objective; inland, sands produce in the Oligocene, Frio, Vicksburg, and Eocene sections.

Drilling

Deep drilling is standard procedure now in field and wildcat wells in South Louisiana with production from 8,000 to below 17,000 ft.

Factors that make South Louisiana drilling extremely hazardous and difficult are blowouts, lost circulation, stuck drill pipe, high-pressure gas zones and salt-water flows. As a consequence, drilling operations in southern Louisiana are expensive and require heavy-duty rigs capable of drilling below 12,000 ft., and highly trained personnel.

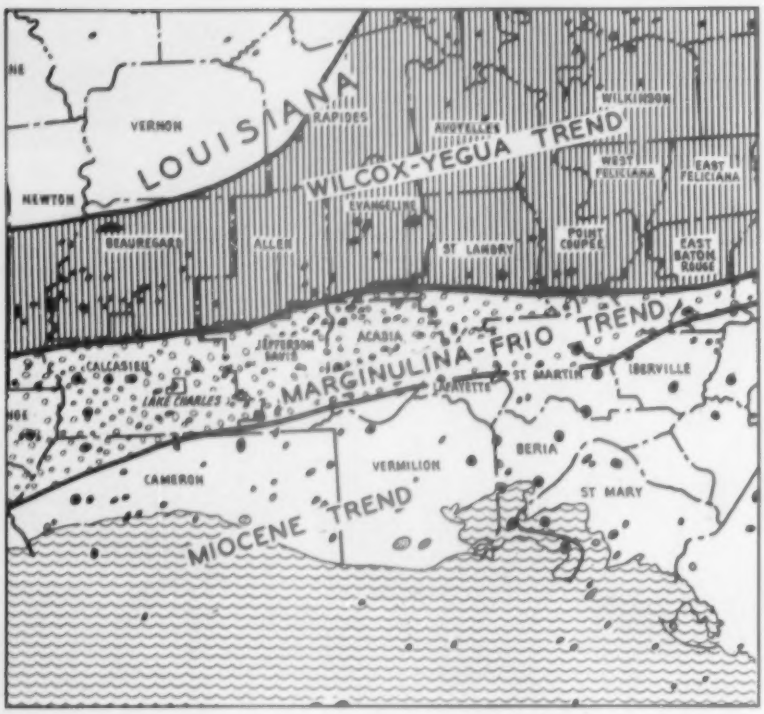
Steam rigs are still used by some contractors because of the cheap fuel and abundant source of water. Operators have even installed evaporators to extract fresh water from the sea on wells drilled along the coast. Recent wells have been drilled using bay water without treatment for muds.

Some oil companies operate their own rigs, although these operators rely on contractors for at least 50 per cent of their drilling commitments. Shell Oil Co. keeps 8 company-owned rigs and 16 contract rigs busy, many of these on offshort operations. The Texas Co., one of the major operators on the Gulf Coast, has 18 barge-mounted and 1 land rig, and in addition contracts for 12 to 15 tools.

Transportation . . . Much of South Louisiana is swampy, especially during the rainy season. There are few roads except in and near populated areas. Moving heavy drilling equipment overland becomes a costly venture, and the expense of filling in a land location may even be prohibitive. As a consequence, most drilling equipment is barge-mounted and contractors use boats for transportation. In some areas crews live on houseboats, especially on wildcat locations.

Operators dredge a channel to the well location and barge in equipment and supplies.

Prices and penetration rates . . . Drilling in South Louisiana is usually on a foot-



The trend in South Louisiana is directed toward developing deep production below 10,000 ft. High-pressure gas zones force contractors to use proper mud programs, sometimes with mud weights of 22 lb. per gallon.

age basis to 10,000 ft. and most contracts contain the so-called "Gulf Coast" clause. This clause covers excess pressures, flow of salt water, lost-circulation problems, and heaving shale. Footage prices vary somewhat, but in May 1954 it averaged between $5 to $5.50 per foot down to 10,000 ft. and then on day rate below this depth.

Penetration rates are fairly high with 1,000 ft. per day common at shallow depths, and in some instances rates as high as 5,000 to 6,000 ft. per day have been logged.

High-pressure zones . . . Abnormally high-pressure zones make deep drilling in South Louisiana extremely hazardous at times, and blowouts are not uncommon. These zones occur along a narrow coastal strip, about 50 miles wide; operators have found similar conditions on several offshore structures.

It is difficult to anticipate these zones and unless proper drilling precautions are taken, blowouts occur with subsequent loss of the hole, and often the rig. Abnormal pressure commonly occurs only below the base of the main sand development in or below a shaly series. These zones may also occur in the main sand series where conditions are favorable for isolation of sand bodies by lensing out or faulting, as at Venice, Lirette, and Darrow.

Frequently these high-pressure zones are found in faulted structures, usually in thin sands containing either salt water or gas; however, high-pressure oil zones are present at Iowa, Chalkley, St. Gabriel, and Manila Village. A thick sand supplied the crater at Bel, La., that produced 7 million barrels of salt water with very little reduction in the flow rate.

Proper control of mud properties and safety precautions are the answer for combating these high-pressure zones. Mud weights of 15 to 16 lb. per gallon are common when drilling below 10,000 ft. and occasionally 20 to 22-lb. muds are used.

Safety devices such as mud-pit-level indicators and automatic gas detectors warn of impending blowouts. Routine daily checks of the blowout preventers are another precaution that prudent contractors take to insure rig safety.

Other drilling problems . . . Salt-water flow and stuck drill pipe are two critical problems on the Gulf Coast.

Some contractors reverse circulation during salt-water flows so that the salt water will not contaminate the hole. One contractor has used this method successfully on 10 different jobs with up to 3,000 ft. of open hole. On one occasion contractor reversed circulation and saved 10,000 ft. of open hole. On occasions, salt-water flows have occurred because the driller came out of the hole too fast.

Washing over stuck drill pipe and spotting oil in the hole are considered the best means of freeing the pipe.

Steep dips on the flanks of salt domes cause crooked holes. Suggested means of controlling deviation are: (1) drill more slowly; (2) use large drill collars; (3) on-the-job experimentation, and (4) reducing the weight carried on the bit.

Contractors have used 9-in. drill collars in a 9⅞-in. hole. In spite of the objection that these large collars are hard to wash over, experience in other areas clearly shows it can be done. At Jumping Pound in Alberta, Canada, Shell has fished for and recovered 11½-in. collars in a 12¼-in. hole.

Mud costs in South Louisiana can be high and may even exceed all other costs in drilling the well.

Casing program . . . Deep wildcats usually require three strings of casing plus a shallow conductor string. In many of the field wells two strings and the conductor pipe are used; deep field wells, or areas where the hole is caving, often need the intermediate string.

Standard completion practice in the past was to set the oil string through the pay zone and complete through perforations. Permanent-type completions, already popular on the Texas Gulf Coast, probably will be used to a greater extent in the future in South Louisiana fields. This method has a distinct advantage over the old type of completion because the rig is released after the oil string is set.

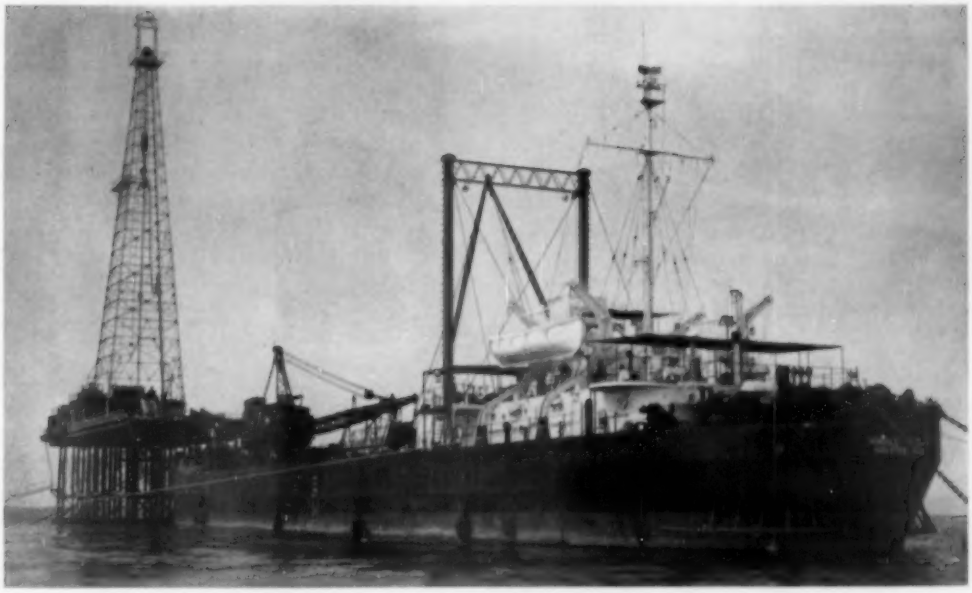
Pay depths . . . No general statement can be made regarding depth to the producing zones along the Gulf Coast. At Weeks Island, for example, sands produce from 2,094 to 17,306 ft.; the latter zone is the deepest producing sand in the state, and second deepest in the world.

Most of the shallow production has been drilled up, and exploration efforts are directed toward locating large reserves at depths of 8,000 to 12,000 ft., or even deeper.

South Louisiana's Future

Oil companies are banking heavily on future production in South Louisiana and keep 90 seismic crews busy mapping new prospects. This is the largest concentration of crews in any one area in the United States and means that exploration and development drilling will continue at a high level for many years.

Recent innovations in drilling, such as jet bits and use of bay water in muds, mean faster drilling at lower costs along the Louisiana Gulf Coast.



Offshore-drilling equipment such as this may cost several million dollars, including the tender. Both platforms and submersible barges are used at the present time, although the trend is toward the mobile installations.

Bits Seek Rich Offshore Production

OFFSHORE production looms as the richest drilling prize in the history of the oil business. Six billion barrels of tideland oil may be added to the United States' reserves in the next 6 years.

Drilling these million-dollar offshore wells will tax the ingenuity of the oil industry as contractors devise new equipment and faster methods of drilling in an all-out effort to reduce the soaring costs. Present-day drilling equipment, platforms, and barges may even become obsolete in less than 2 years.

Transportation of men and equipment is one of the major costs and contractors and oil companies must have small flotillas at their disposal, capable of handling the unusual demands imposed by water drilling.

Offshore exploration has brought in 14 fields with a daily production of 25,000 bbl. Major companies believe that this is only a drop in the bucket and feel certain that many major fields remain to be discovered.

Costs . . . Offshore development drilling is at least three times as expensive as land-based operations; equipment costs probably are seven times higher than on land because of the need for boats, costly platforms, and communication setups.

Extended drilling operations require an elaborate shore base capable of handling and loading large equipment as well as quarters for personnel. Cost for this installation may exceed $150,000.

The number of boats needed for offshore operations nearly places the contractors in the shipping business. If a drilling tender is used, the cost of boats may exceed 3 million dollars. Of course, in the early stages of drilling, it is possible to rent these or rely on the oil companies for this equipment. However, it may be cheaper for contractors to use their own equipment if they plan a long-range offshore drilling campaign.

Equipment . . . Newcomers to offshore operations immediately conclude that Rube Goldberg has deserted the comics and turned his hand to designing drilling equipment. However, many of these weird innovations have already proved their worth in offshore waters.

Present trend in offshore drilling equipment stresses mobility because of the tremendous expense in building platforms. Submersible barges, mobile platforms, and elevated barges are replacing the drilling platforms. Ocean Drilling & Development Co. now has a submersible barge in operation that has the engines and pumps in the hull. This barge has an elaborate ventilating system that permits both men and equipment to operate safely in the watertight hull under 60 ft. of water.

Contractors favor the use of submersible barges or mobile drilling platforms with a drilling tender for men and equipment. The California Co. at Main Pass Block 69, however, uses a six-well platform serviced by a converted LST. Crews work 12-hour tours and live on the ship for 2-week stretches.

Some contractors prefer to ferry crews to and from the offshore locations, as this eliminates the problem of living quarters, overtime, and the expensive drilling tender. Crews receive travel pay at a much lower rate than their regular hourly pay. However, as locations are pushed farther out to sea, this practice may be discontinued.

Aerial tramways are another solution to the transportation problem, because one of the main troubles in the past has been the high seas that prevent operators from landing men and equipment. During the hurricane season, servicing of the offshore rigs is hazardous, because a tropical storm generates heavy seas that affect areas hundreds of miles from the storm center.

Contractors use standard steel derricks with heavy-duty draw works, capable of going to 12-15,000 ft. The California Co.'s six-well rig uses three diesel engines rated at 600 hp. each and two C-350 pumps with two standby pumps.

Transportation problems force operators to maintain a mud supply at the well that will be adequate for any emergency such as a lost-circulation zone or a blowout.

Offshore Drilling

Drilling is similar to onshore Gulf Coast work with the ever-present danger of blowouts, lost circulation, crooked holes and key seats. Since contractors often drill several wells from the same platform, drilling is slowed down because of the whipstocks that are set in the slant holes.

At the present time there are 25-30 rigs active in offshore drilling. These rigs are scattered along the coast from Corpus Christi to the Mississippi delta with only a few confined to any one field. All are seeking production from the rich Miocene sands that are so prolific along the Gulf Coast.

Main Pass Block 69 . . . Operations at this field are an indication of what contractors can expect during offshore drilling. The California Co. is using its six-well platform here, drilling one vertical and five directional holes.

The derrick, draw works, motors and pumps are mounted on a permanent platform set on steel pilings. The LST tender serves as quarters for the crew and as a supply and storage ship for the drill pipe, casing, and mud.

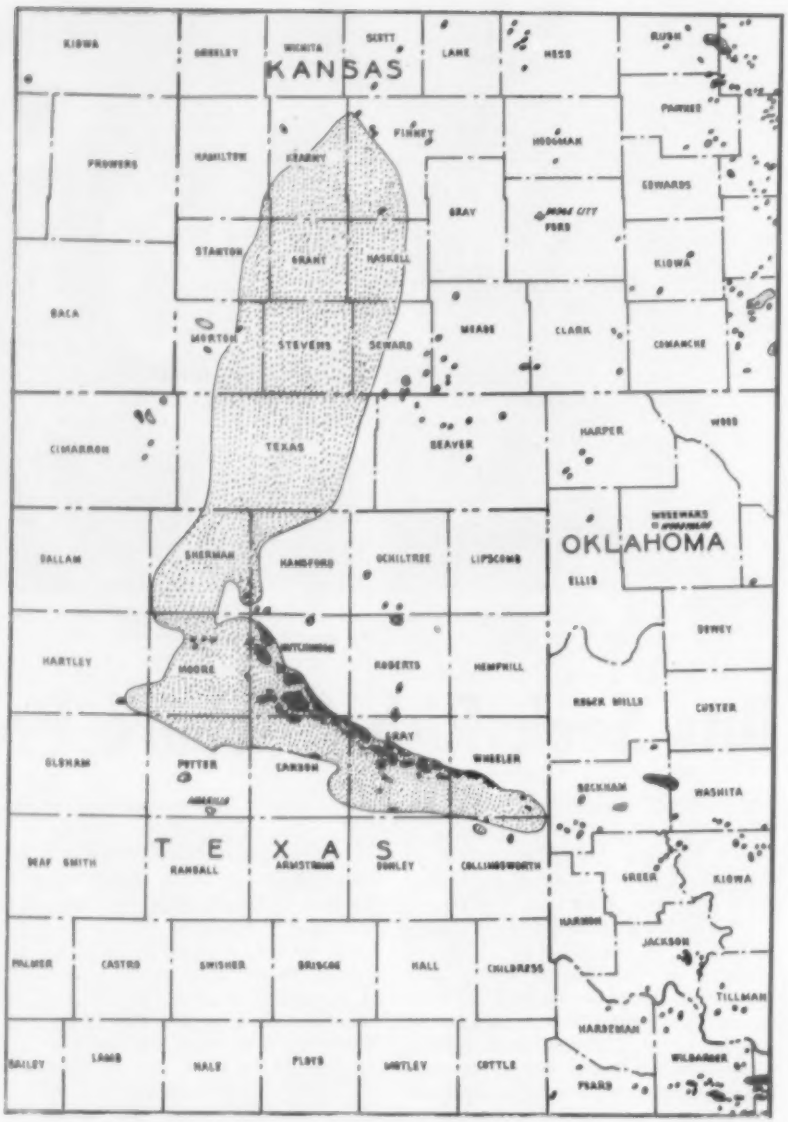
Operators use three strings of casing plus a shallow 26-in. conductor string. The latter is driven into the ocean floor by a pile driver to a depth of 230 ft. The contractor uses a 10.6 lb. mud from 1,300 ft. to total depth of about 8,500 ft.

Whipstock programs vary from hole to hole, but one well was whipstocked 3,600 ft. out from the platform at total depth, or about 27° off vertical. Operations in this field are on a day-work basis with the contractor receiving $1,273 per day.

Offshore gamble . . . Offshore operations are a tremendous gamble, with the distinct possibility of a blowout or fire costing several million dollars and the loss of several lives. Oil companies consider that the "game is worth the candle" and have invested millions of dollars in preliminary exploration and drilling programs. Since the clarification of the tidelands issue, the quest for new reserves has steadily increased.

Oil company representatives have stated that 6 billion barrels of reserves will be found in the next 6 years on the Continental Shelf. This means that 50 or 60 major fields will be located in this time. It is estimated that a minimum of 500 wells per year will be drilled in developing these offshore fields, based on estimated reserves of 2½ million barrels of oil per well.

Offshore drilling is in its infancy and has a long and prosperous life ahead of it.



Successful wildcatting in the Hugoton embayment during the past few years has uncovered many new fields, particularly in Hansford County, Texas.

Mid-Continent Still in Forefront Of Nation's Busy Areas

SUCCESSFUL wildcatting in the Texas and Oklahoma panhandles and southwestern Kansas marks the beginning of an active development program for the Hugoton embayment.

In the past most of the drilling was confined to the old Panhandle gas field and relatively few deep tests were drilled outside the limits of the field. Operators now are seeking deeper pays beyond the known Permian gas-producing areas, and many wells are being drilled on the flanks of the old field. The results of this campaign in the first half of 1954 speak for themselves: 24 important discoveries and a 20 per cent increase in drilling over 1953. This is one of the hottest areas in the country, and the successes of the past year clearly show that development drilling will increase.

Central Kansas uplift . . . Routine drilling marks the older Kansas areas with

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Making hole faster with Security bits isn't new. It's done every day. Here are the results of two rigs drilling offset wells with Security rock bits in the Williston Basin.
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Security rock bits with their new cutting patterns, advanced bearing design and metallurgy can do the same outstanding job for you. *Get Security in Your Drilling.*
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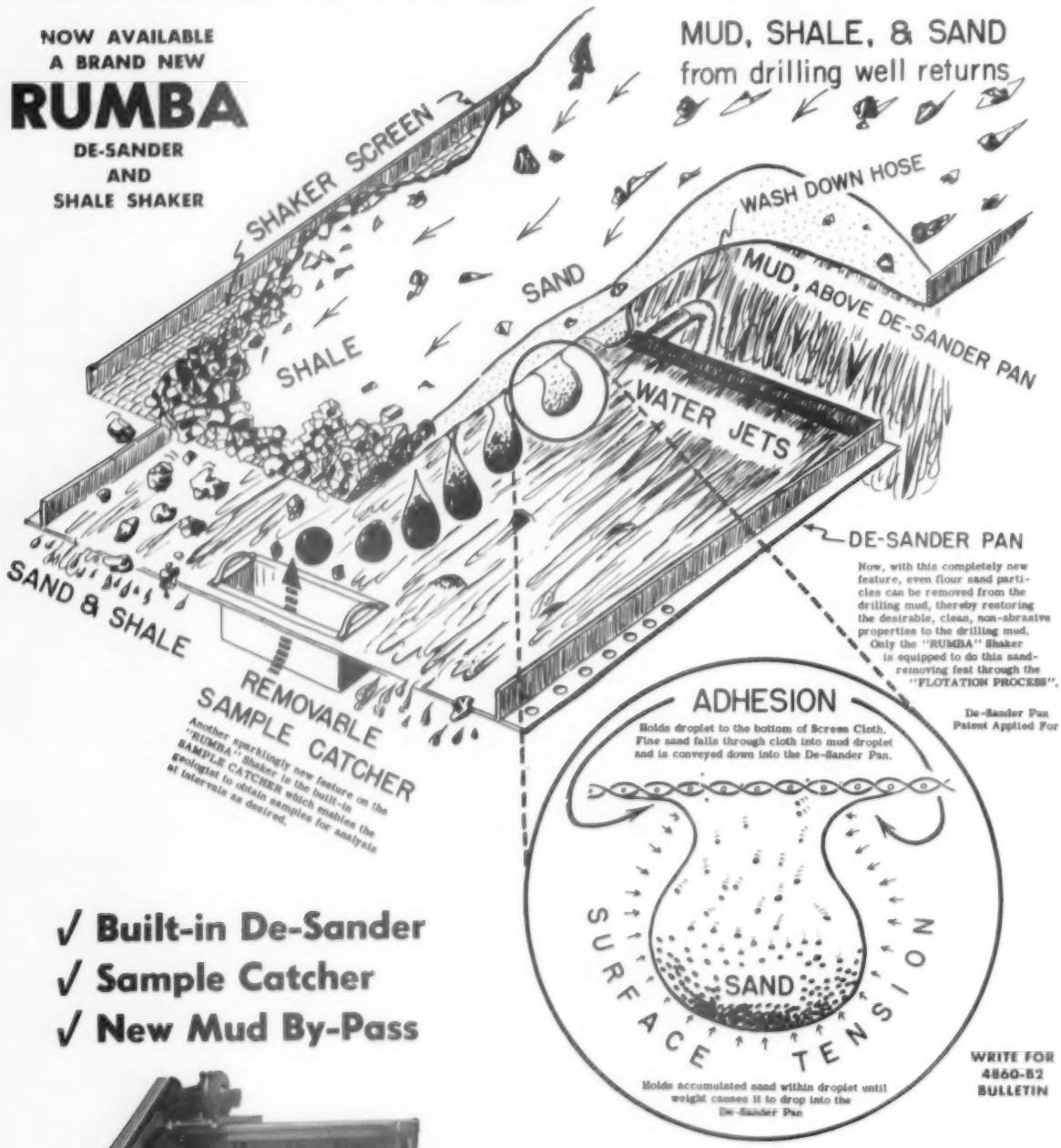

Now, with this completely new feature, even flour sand particles can be removed from the drilling mud, thereby restoring the desirable, clean, non-abrasive properties to the drilling mud. Only the "RUMBA" Shaker is equipped to do this sand-removing feat through the "FLOTATION PROCESS".

De-Sander Pan Patent Applied For

Another sparklingly new feature on the "RUMBA" Shaker is the built-in SAMPLE CATCHER which enables the geologist to obtain samples for analysis at intervals as desired.

Holds droplet to the bottom of Screen Cloth. Fine sand falls through cloth into mud droplet and is conveyed down into the De-Sander Pan.

Holds accumulated sand within droplet until weight causes it to drop into the De-Sander Pan

✓ Built-in De-Sander
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✓ New Mud By-Pass

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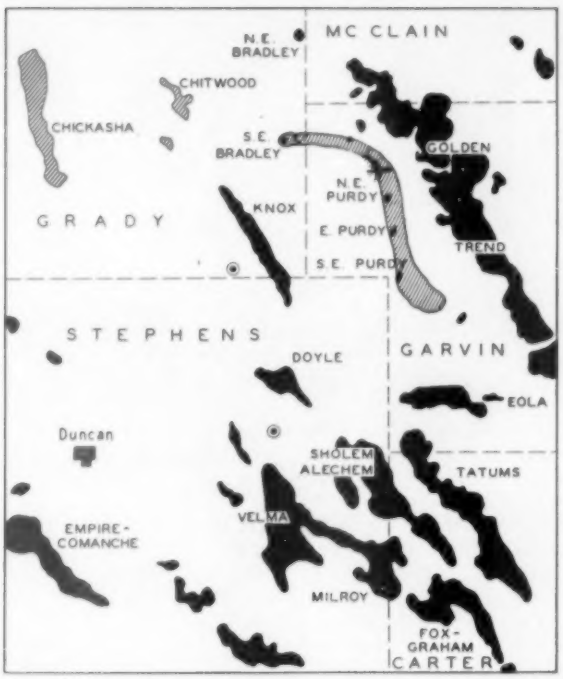
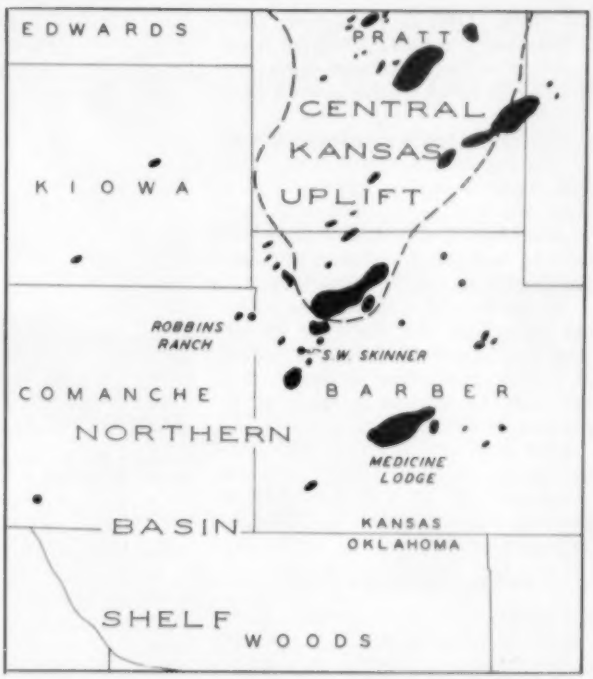


Springer production at 9,500 ft. along the Golden Trend of Oklahoma (stippled area) is rapidly expanding and keeps 40-50 rigs active.



Independent operators dominate the drilling picture in the Central Kansas uplift. Drilling is fairly routine in this old shallow area.

independents and small operators active. Shallow Lansing-Kansas City, Simpson, and Arbuckle production is found at depths ranging from 2,000 to 4,500 ft. Although Kansas will continue to be an important oil-producing state, new discoveries are needed to prevent a decline in the Central Kansas Uplift.

Oklahoma . . . The Sooner State is in the midst of a minor drilling boom, even in the face of a decreasing demand for Oklahoma crude, and completions are about 25 per cent higher than the 1953 figure. These figures do not include the vast number of shallow (1,500 ft. or less) cable-tool holes drilled in the northeastern part of the state in the "stripper"areas.

Most of Oklahoma's activity is concentrated in the central and north-central part of the state where Pennsylvanian sands are the primary objective.

Drilling on the Golden Trend of Garvin County has been stimulated by the deeper Springer sand play and wells in the area are set up for 9,000 to 10,000-ft. tests of these sands. Phillips Petroleum Co. recently completed the deepest oil producer in the state in the Bradley area from the Simpson sands at 13,804 ft. This discovery will undoubtedly touch off a series of deep tests to these prolific sands.

Drilling for the Deese, Springer, and Simpson sands on the Golden Trend will continue for several years. Fast drilling and multiple pay zones are ample reasons to justify wells and the oil potential of the deep sands on this trend has barely been scratched.

In southern Oklahoma, development drilling is concentrated in Carter and Stephens counties with Springer sands as the primary objective. Depth to the producing zones is highly variable as the geology of the area is very complex. Velma, East Velma, Sholem, Alechem, and Doyle are all active; shallow Springer production at Caddo, Madill, and Aylsworth is of minor importance.

Elk City is the only large field in the Anadarko basin and very little field drilling is being carried out in this part of western Oklahoma. Wildcat results in 1954 for the Anadarko basin have been discouraging and the outlook for extensive drilling is not bright until additional discoveries are made.

Springer gas production in the North Gotebo area has not yet reached major importance and development has been retarded by the lack of a pipeline outlet and by erratic pay sands.

Hugoton Embayment

Over 50 rotary rigs are active in the current intensive drilling program in the Hugoton embayment. Although many of these are termed deep tests, the majority of the wildcat wells fall in the 5,000 to 7,500-ft. category and most of the field wells average 5,000 ft.

Liberal, Kans., is one of the main supply centers of this vast area that covers some 30,000 sq. miles. Most of the terrain is relatively flat and transportation of equipment is not a problem.

Two casing programs are currently used; one calls for an intermediate string and the other calls for only surface casing and the oil string. In Cimarron County, contractors normally run three strings, setting surface pipe at 400-600 ft., and intermediate around 2,600 ft. The oil string is set on bottom at about 5,000 ft. through the pay zone. One of the main purposes of the intermediate string is to shut off troublesome sands that cause lost circulation and stuck drill pipe. Recently operators have been using two strings of casing, running the surface casing to 1,500 or 1,600 ft. to seal off these sands. Around the old Hugoton gas field, the intermediate string is also used to seal off the uneconomic Permian gas zones that are productive updip. The casing program in Meade County is similar to the rest of the embayment.

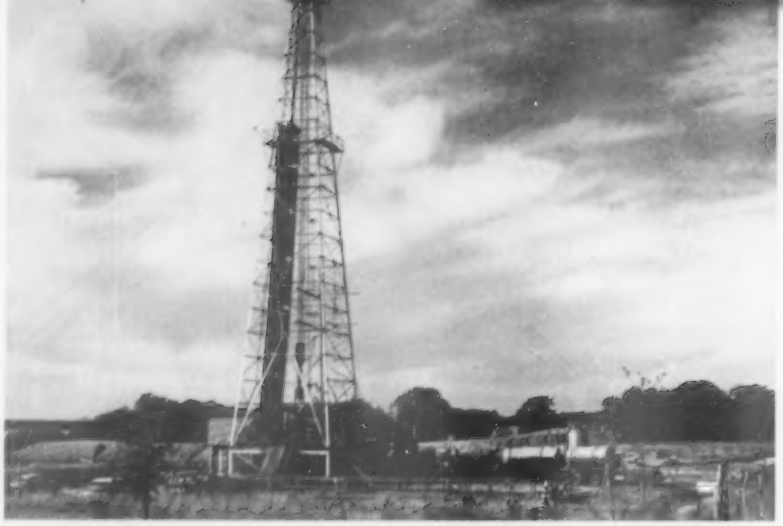
Field wells in the Keyes area average 4,800 ft. and require about 16 to 18 days to drill, based on a detailed survey of 10 wells. Normal rig-time distribution is about 13 days on footage and 4 to 5 on day work, such as coring, testing, and running surveys. Some operators require less coring, and rig-time distribution may run about 90 per cent on footage and 10 per cent on

day work. Over-all penetration rates in this study averaged 8.67 ft. per hour, including waiting on cement; rigging up and tearing down require about 3 days per well.

Drilling in Meade County, Kansas, is comparable to Cimarron County with field wells averaging 5,345 ft. Here three strings of casing are run and wells require 30 to 32 days to drill with 26.6 days on footage. Penetration rates are slightly lower, or 8.38 ft. per hour.

Jet bits have been used in the Hugoton embayment, but there are insufficient data to evaluate fully this method of drilling. Indications are that footage time may be reduced as much as 10 per cent by the use of jet bits.

Mud costs are relatively low with average mud bills of about $5,000; lost circulation can be a severe problem, however, with occasional mud bills as high as $20,000 per well.



Several wells in Eola field have cost over $500,000 each; here steep dips and faulting complicate the drilling.

Oklahoma's Golden Trend

Drilling rates in the Golden Trend have been increased about 25 per cent during the past 12 months. A year ago it required 60 days to drill and complete a 9,500-ft. test. Now wells are drilled to this depth in 40 to 45 days. Main reasons for this increase have been drilling with water, the number of drill collars carried, the rotary table speeds, and increased mud velocities.

Average 9,500-ft. wells require 50 to 55 bits and take 40 to 45 days to complete. Most wells are fractured prior to completing and dual completions are common. Drilling problems are not unusual, although the Springer shale will slough off during drilling and may cause the drill pipe to stick.

Southern Oklahoma . . . Drilling in southern Oklahoma for Springer sands presents a variety of conditions as depths range from 1,500 ft. in the Madill field to below 12,000 ft. at Chitwood. Principal problem on field wells is the sloughing Springer shale and the subsequent sticking of the drill pipe. In many areas it is difficult to maintain straight holes because of the steep dips. Occasionally contractors must plug back and set a whipstock to straighten the hole.

Eola pool in southern Garvin County has some of the most expensive field wells in southern Oklahoma with 10,000 to 12,000-ft. wells costing $250,000 to $400,000. Bit costs are high with 10,000-ft. wells requiring an average of about 150 bits. On the Stanolind Oil & Gas Co. 1 McKee, Sharon Drilling Co. used 188 bits to a total depth of 10,624 ft. Contractors require about 6 months to drill these wells, and fishing jobs may increase the time by one third or more. Crooked holes, key seats, and occasionally stuck pipe all contribute to make the drilling in this field as difficult as in any field in the country. Few contracts are awarded on a footage basis and day-work rates are $850 to $1,000 per day.

In the Northeast Gotebo area, steeply dipping beds and thrust faulting complicate the drilling. Gas production is from Springer sands found at 6,000-6,500 ft. Most wells cut a major thrust fault and pass from pre-Springer beds into Springer shale. Zephyr Drilling Co. completed one 6,500-ft. test in 58 days. Hole deviation is largely controlled by reducing the weight on the bit and the use of long-tooth rock bits. Considerable difficulty is experienced in keeping the hole straight while drilling through the fault zone. Development in this area has been retarded because of the lack of a pipeline, and this problem must be solved before a large-scale development drilling program is undertaken.

North-Central Oklahoma . . . Fracturing has made Pennsylvanian sands a paying proposition in north-central Oklahoma. Bartlesville, Layton, and Red Fork sands have replaced the second Wilcox in the present drilling campaign and are found at 2,500-3,000 ft. Both cable tools and rotary rigs are used in this area, and well costs are relatively low. Average 3,000-ft. wells require 12 days to drill. Usual practice is to drill through the pay after setting surface pipe, and then cement the oil string on bottom. Operators often use cable tools to perforate the pay zone, fracture the well, and complete it.

Independents and drilling contractors are the main operators in North-Central Oklahoma, although some large companies are active. Little Chief is typical of fields in the area. Discovered in 1952, the field has a daily production of 1,900 bbl. from 77 wells; pay zone is the Burbank sand found at 2,800 ft. Footage rates are about $3.20 per foot and day rates $514 with drill pipe and $482 without. Sunray Oil Corp.'s recent success at Little Chief field and the active leasing in western Osage County mean that more wells will be drilled and that the area will continue to be a hot one.

Northeastern Oklahoma and Eastern Kansas

Formation fracturing has revived the drilling in northeastern Oklahoma and eastern Kansas and about 300 rigs are busy, most of them cable tools.

Shallow erratic Pennsylvanian sands at 1,000-2,000 ft. are the principal objective and the work is carried out by small operators who own their own rigs.

Well costs are low with a 1,200-ft. well completed for $8,400 or even less. Most contracts are let on a footage basis at about $2.25 per ft. Cable-tool operations require 7 to 10 days while light rotaries drill these 1,200-ft. holes in a few days. Few drilling problems exist as the area is underlain by flatly dipping beds with abnormally low pressures. Standard practice is to fracture all wells, either through perforations or "barefoot."

Mid-Continent's Future

Much of the Mid-Continent is considered an old oil province but the current drilling proves you can never rule out an oil province regardless of age.

Within the Mid-Continent are many basins that have tremendous oil possibilities, that are as yet undeveloped. The Hugoton embayment, McAlester basin, southeastern Oklahoma, and the Anadarko basin are only a few. Successful wildcats in any one of these provinces may alter the reserve picture overnight and stimulate drilling activities.

Bethlehem M-58

. . . a rig with surplus power for medium drilling

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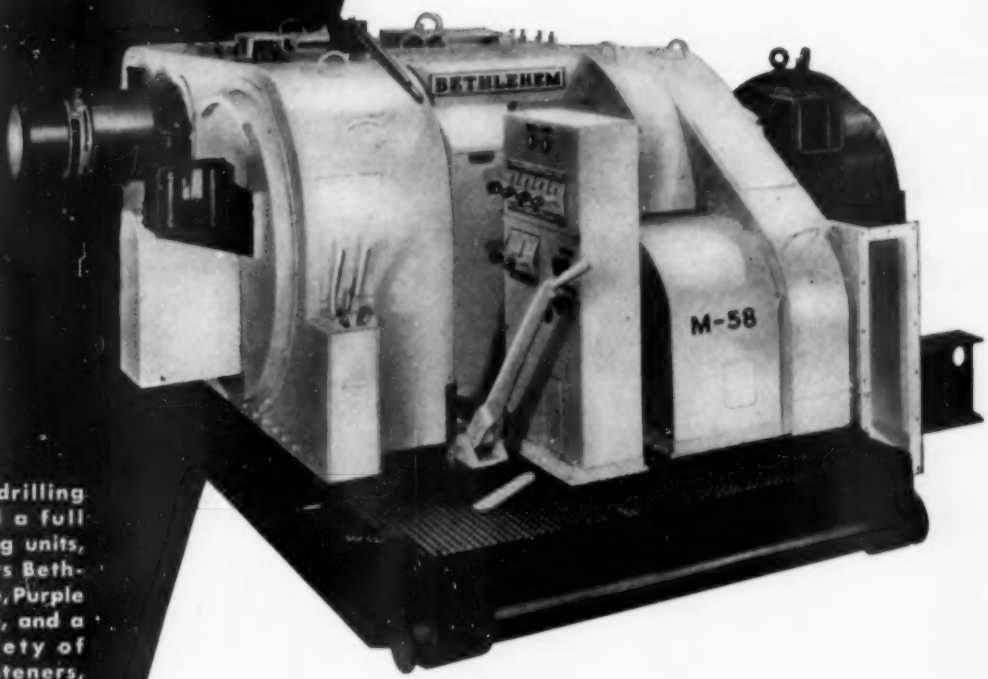

In addition to drilling equipment and a full range of pumping units, Bethlehem offers Beth-Co-Weld line pipe, Purple Strand wire rope, and a complete variety of sucker rods, fasteners, etc. Ask for these products when equipping your oil-country installations.

For jobs of medium depths, you'll never find a more powerful rig than Bethlehem's M-58. It's a drawworks with short, strong shafts, heavy chains, big brakes, and high clutch capacity (59,000 ft-lb in the low-speed drum clutch). There's extra power, extra strength, in all the vital working parts, yet nothing is burdened with excess weight.

Though strictly a heavy-duty unit, the rig is very compact and is easy to move from job to job. The engine compound is of sectionalized type, so that the outfit can readily be broken down into loads of required road widths.

Many applications require a drawworks with an upper drum, and we now offer this equipment with the M-58. The upper drum, however, is strictly an optional feature; one you can specify or not, as you choose.

Speaking of optional features, there are several other good ones. The choice of drives, for instance. The M-58 is offered with regular mechanical drive, with fluid coupling, or with torque-converter. The unit also permits its owner complete latitude in the choice of engines and engine combinations.

Why not investigate these and other advanced features of the M-58? Our nearest office will gladly furnish full details.

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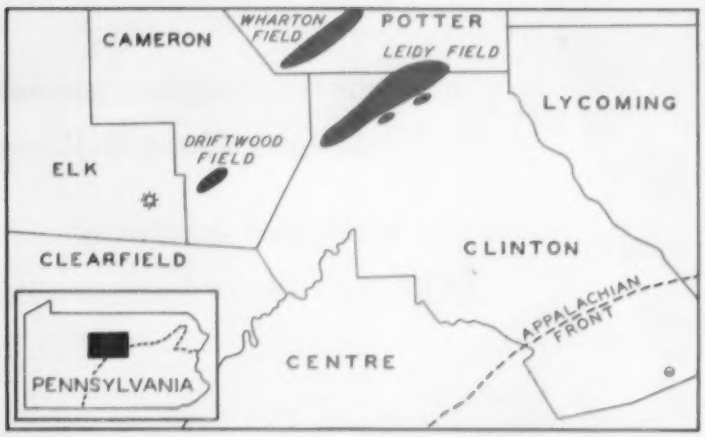
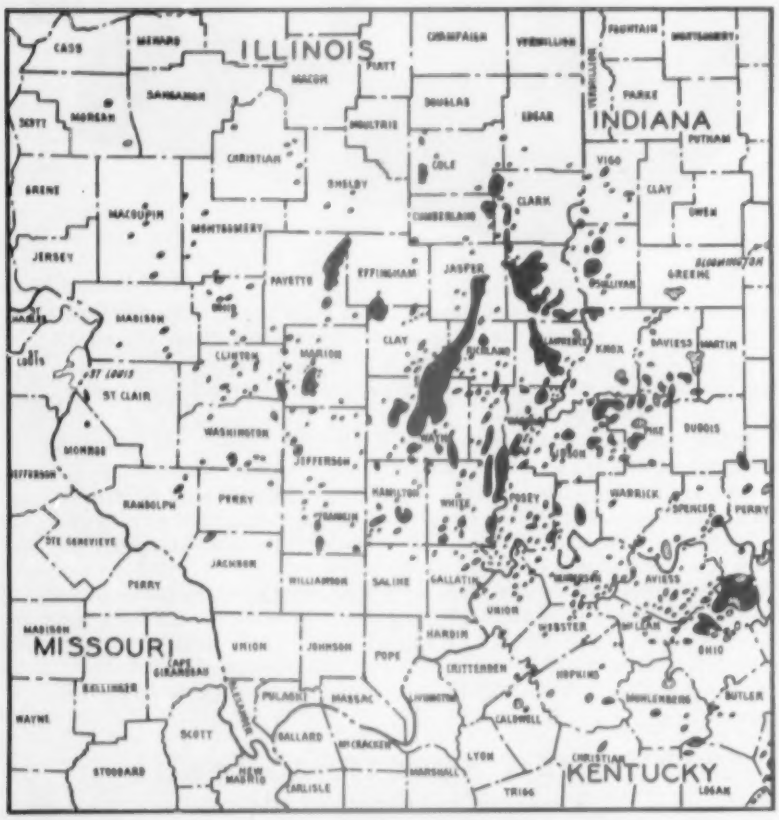


Drilling with air or gas is becoming more prevalent in the Appalachian gas fields and has cut down over-all drilling time by as much as 6 days per well.

Trenton production in Washtenaw County (A above) has stepped up Michigan's current drilling.

Steady Drilling Continues in Areas East of Mississippi . . .

Appalachians, Illinois, Michigan, Southeast



Fracturing has rejuvenated development drilling in the Illinois basin and well completions are up 50 per cent over 1953. Independents are active in the area because the pay zones are found at 3,000 ft. or less.

APPALACHIAN gas fields* . . . Rotary-drilling problems in the Appalachian gas fields are few and, for the most part, relatively minor. Fortunately, the more serious problems have been or are being solved.

One of these more serious problems is the loss of circulation encountered by wells drilling at the higher elevations which penetrate Pennsylvanian and Mississippian rock formations. This problem has led to the use of air as a circulating medium by several contractors. The first use of air was by Delta Drilling Co. and has been so successful that this company is now drilling entirely with air. Contractors using water as a circulating medium can, in most cases, overcome this loss of circulation by using sawdust and maintaining a high mud viscosity; considerable time is lost in the process, however.

The difficulty of obtaining replacement parts and special fishing tools has caused several days of shut-down time on many rigs while a part or fishing tool was being flown in from some distant point in Texas or Oklahoma. Rig moving is expensive in the area due to the mountainous terrain and nearly impassable roads in the spring months.

Maintaining an adequate water supply for mountain top locations is difficult in the late summer due to many streams going dry. In the winter the long water lines to these mountain locations present a freezing problem.

A few wells have encountered blowouts in and below the Tully limestone. These blowouts are usually from high-pressure gas pockets in the Tully or shale section below the Tully and present a fire hazard.

Contractors using air have found

* This discussion is by Carl H. Roberts, consulting geologist, Coudersport, Pa.

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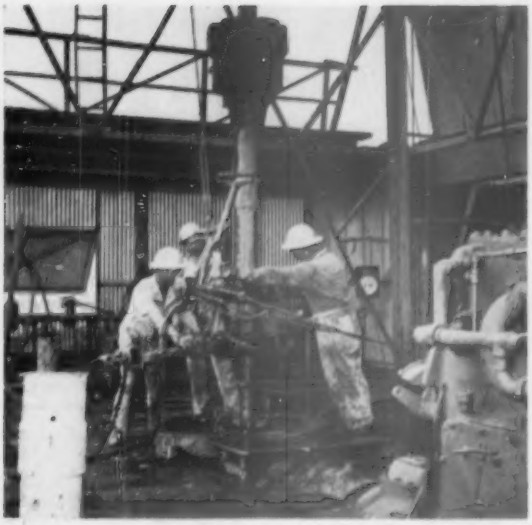
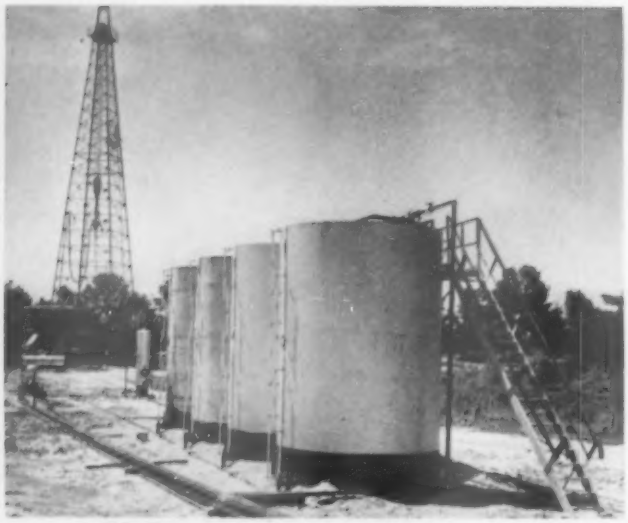




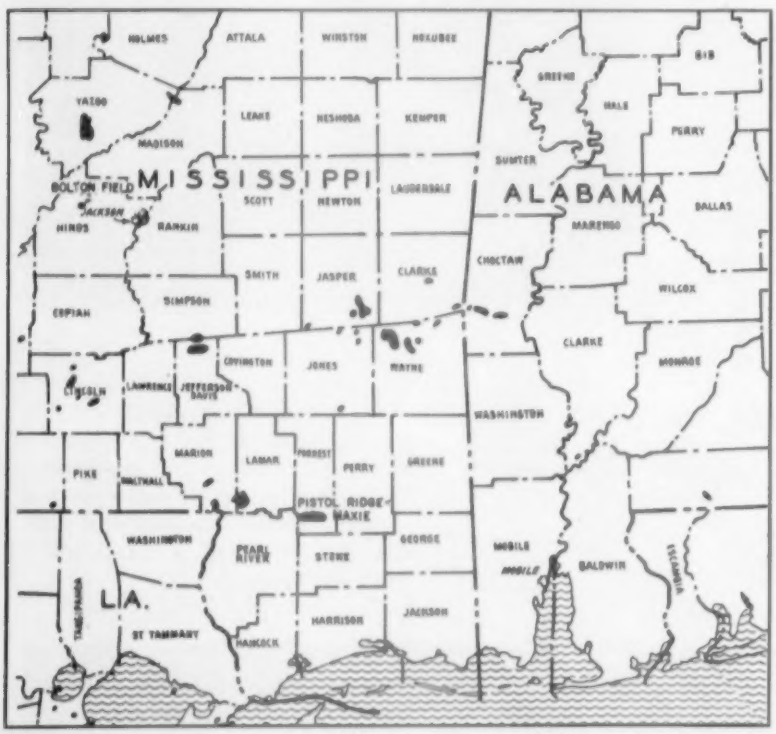
Drilling operations in southeastern United States are aimed at developing deep pay zones and require heavy-duty rigs and equipment. Recent wildcat successes may be the beginning of an active exploratory drilling campaign. (Photos courtesy Carter Oil Co.).

that too much weight on the bit will cause the hole to deviate considerably from the vertical and, consequently, an optimum weight must be ascertained to prevent this situation.

Illinois . . . Well completions in Illinois have increased 50 per cent over 1953. Cable tools and rotaries are kept busy drilling the shallow 1,000-3,000 ft. holes. Most of the drilling is in Clay, Clinton, Christian, Crawford, Hamilton, Marion, Wabash, Wayne, and White counties. Principal pay zones are sands in the Chester series and Paleozoic limestones.

Fracturing has made many of the shallow sands economic and revived drilling in several fields. Wells in the 2,600-ft. class are completed in less than 2 weeks. Footage rates are fairly uniform at $3.75 per ft.; day work with drill pipe costs $400.00 per day.

Michigan . . . Development drilling in Michigan is on a par with 1953; over 300 wells were drilled during the first 7 months, about half of these being wildcats. Discoveries in Washtenaw County mean that development and wildcat drilling in this county will probably increase. The Trenton limestone, the main pay zone at Northville field, is found at 4,400 ft.



The recent Paluxy strike at Bolton field in Hinds County means more drilling for Mississippi.

Southeastern United States

Mississippi . . . Larco Drilling Co.'s recent Paluxy discovery in Hinds County has touched off an active lease play that will be followed up by more deep drilling for Central Mississippi.

Tuscaloosa production at 8,600 ft. keeps several rigs busy in the Maxie-Pistol Ridge area. Here the drilling is relatively easy, although transportation becomes a problem during the spring rains when operators are forced to build roads to the well location.

Drilling activity in the Black Warrier basin is leveling off. It is expensive digging in this basin with 4,000-ft. wells requiring as much as 90 days to drill.

Alabama and Florida . . . Very little field drilling is taking place in these two states with only Gilbertown field in Alabama and Forty Mile Bend field in Florida now active. Successful wildcatting, however, could alter this picture rapidly and stimulate an active program. Oil companies regard both these states highly as they have excellent oil possibilities.

Check the Chart!

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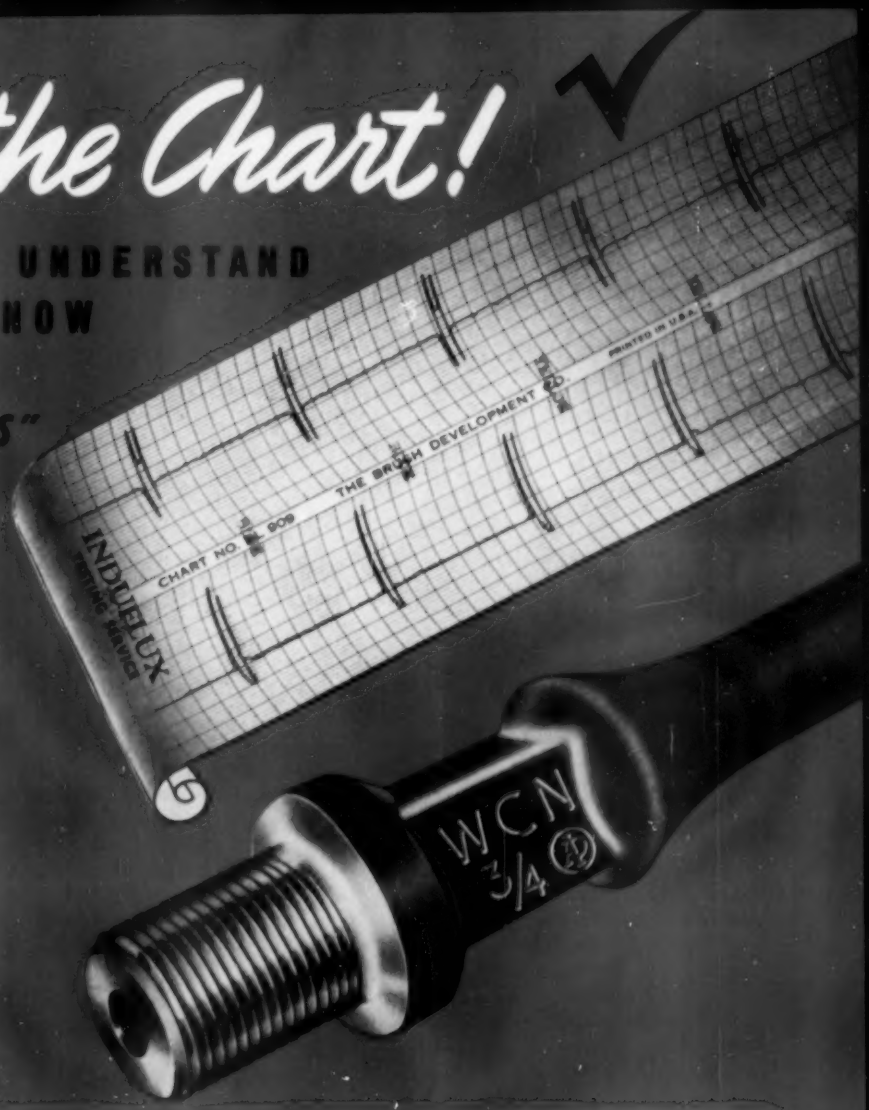

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Correct metallurgical techniques — careful visual inspection — result in Norris Quality Sucker Rods—Proved by tests—Proved in service—SOLD THROUGH YOUR FAVORITE SUPPLY STORE.

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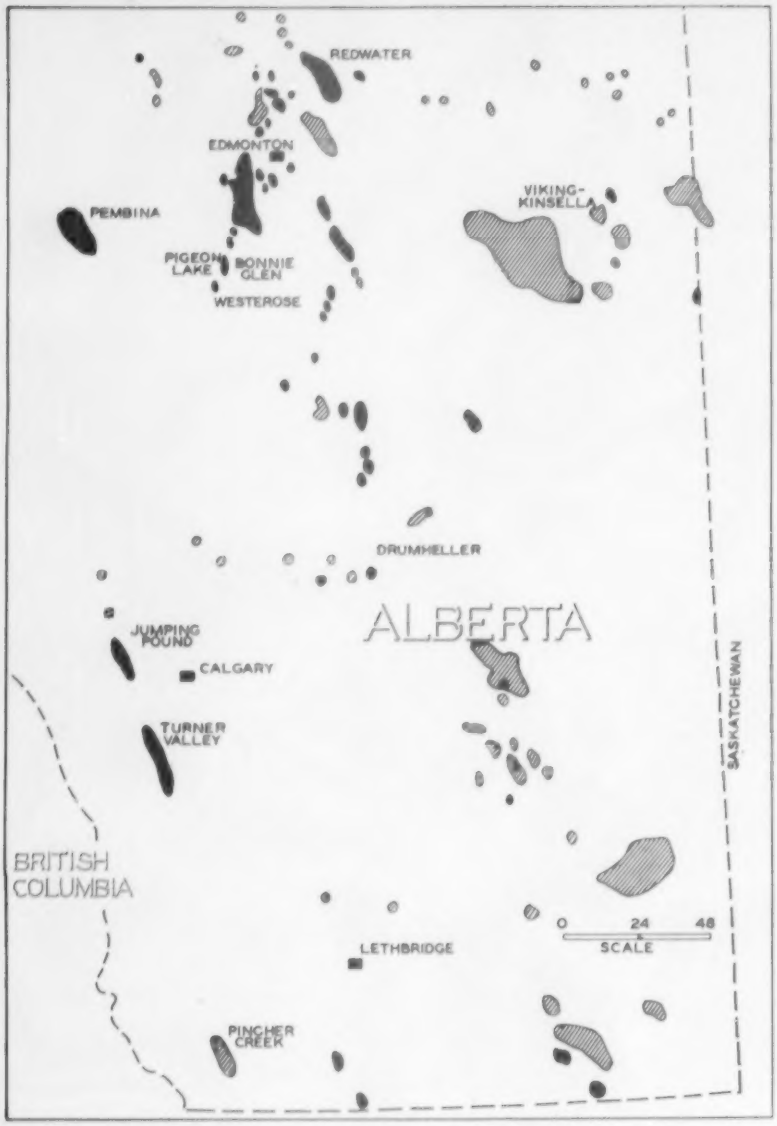

Summer weather seriously hampers Canadian drilling as the muskeg becomes nearly impassable. With the advent of winter, drilling will increase.

Aggressive Drilling in Canada Awaits Suitable Markets

PEMBINA, with over a quarter million proven acres, is the hub of the Canadian drilling activity. Cardium sand production at 5,500 ft. has pushed the reef fields into the background.

Weather conditions have forced operators to plan a long-range drilling campaign with 25 rigs active rather than a rapid expansion of Pembina. During summer months, the muskeg becomes a bog and at times operations are completely at a standstill. Some contractors during the past summer's rains could not get to their rigs for nearly 2 months.

Shallow drilling at Virden-Roselea in Manitoba has attracted independents to this part of Canada, because the 2,500-ft. Mississippian wells can be completed for $25,000. Farmout deals with dry-hole commitments enable contractors to drill five or six of these wells for the price of one reef test. This play probably will spread into the United States, giving the east side of the Williston basin a much-needed shot in the arm.

Drilling activity on the reef trend keeps 25 rigs busy. Most of this is centered at Bonnie Glen, Drumheller, Fenn-North Big Valley, and Sturgeon Lake in Alberta.

Deep production at Jumping Pound and Pincher Creek in the foothills of Alberta means expensive drilling with some field wells requiring 6 to 8 months to drill. Although only a few wells are being drilled along this important trend, recent seismic activities and leasing mean that more exploratory tests will be drilled. Steep dips and faulting complicate the drilling and a wildcat may cost over one million dollars.

Pembina and reef drilling . . . Drilling on the Pembina trend to the Cardium sand offers few problems apart from the weather. Operators winterize their rigs and occasionally heat their mud to prevent it from freezing during the sub-zero weather. Most rigs are equipped with steel mud tanks as it is impossible to dig mud pits in the muskeg. Operators usually fracture Cardium wells after setting the oil string through pay.

Lost circulation and crooked holes are the main problems on the reef trends, but contractors now have enough experience in these areas so that drilling has become fairly routine.

Foothills belt . . . Operations at Jumping Pound and Pincher Creek pose severe problems to the drilling contractors because of the steep dips, faulting, and rugged terrain. Many 10,000-ft. wells in Jumping Pound field required over 170 days to drill. Recently Shell Oil Co. has used large drill collars. This new approach has cut rotating hours in half on two wells; the number of rock bits was reduced from 220 on early wells to as low as 81 on its No. 12 well.

Shell used 11¼-in. drill collars in a 12¼-in. hole with bit weighs ranging from 30,000 to 70,000 lb. Maximum penetration rates occurred with 30,000 to 40,000 lb. on the bit and a rotary table speed of 150 r.p.m. *(see The Oil and Gas Journal July 26, 1954, page 216).*

Canada's future . . . During the past 7 years, the Canadian oil and gas industry has become an important factor in world production. At the present time, lack of suitable markets seriously curtails aggressive drilling programs. In spite of this, Canada attracts both independents and majors with production from 2,000 ft. to below 12,000 ft.

Canada's drilling industry today is comparable to that of West Texas during the late 20's and early 30's. In 8 years Canadian production has climbed from 21,000 to 250,000 bbl. per day. If successful drilling continues to increase as it has done in the past, Canada's production in 1960 will exceed 500,000 bbl. of oil per day.

FULL CAPACITY of this mud pit is ready for immediate use. No mud is lost by settling. Mud is same weight and viscosity throughout—held in uniform suspension by this LIGHTNIN Mud Mixer.

HEAVIER MUD is obtained almost instantly, by adding weight material through LIGHTNIN Flash Mixer in open-bottom well.

SAVE $67 out of EVERY $100 on upkeep of mud mixing equipment

Mix mud this new, faster, low-cost way that *saves wear* on pumps, valves, fittings

You can knock the spots out of maintenance cost, with a new mixing method that gives you fast, positive control of drilling muds.

This method—proved on over 100 U.S. rotary rigs—can save you as much as half or two-thirds the cost of replacing pump parts, valves, and fittings you now use for mud agitation.

It frees you of the cost of using and maintaining a standby pump for jetting mud. It mixes mud with a small fraction—1/10 or less—of the horsepower normally used for mud mixing.

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HEAVIER MUD—IN SECONDS. To get heavier mud, you dump weight material into a flash-mixing well as fast as you want—one whole sackful right after another. You get an *immediate* rise in weight throughout the whole mud system. A few seconds is all it takes to increase weight of every gallon of mud by the exact amount you want.

You get *immediate* dispersion of gel ingredients—with fully uniform viscosity in about 20 minutes.

All the mud in the tank or pit stays in circulation—can't settle out. The full tank or pit capacity is there when you need it—ready for instant use.

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The entire mixing job is done with only 10 to 25 horsepower, depending on tank or pit size. You eliminate use of a standby pump—and have full capacity of your main mud pump always available for pumping mud down the hole.

The mixers are fully assembled units, ready to install. They eliminate piping, pump connections, valves, jets and hoppers. The only parts in contact with the mud are the mixer impellers—built to resist abrasion, yet easily replaced at any time for less than the cost of a single valve.

FULLY GUARANTEED. LIGHTNIN Mud Mixers are *unconditionally guaranteed* to do the mixing job right for you on your rigs. Without risking one cent, you can get facts that may save you 67% of your present mud mixing upkeep cost. It's worth a try! For full details and name of nearest LIGHTNIN oil country sales engineer, write or wire us today.

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FOR BEST RESULTS LOG AND PERFORATE BY McCULLOUGH

Journal's Fifth Annual Census of Rotary Drilling Shows

Rotary Contractors Increasing in Number

IN spite of this year's steady decrease in number of active rotary rigs, the number of drilling contractors in the industry is increasing. Since the time of the Journal's survey in 1953, number of rotary contractors has gone up from a total of 1,146 to a total of 1,203. Not only that, but these contractors own more rotaries than last year, even if they aren't working. Last year, all the contractors owned 3,608 rigs; this year they have 3,829 rigs.

It, of course, requires more people to man those rigs. Rotary contractors now hire 52,187 drillers and rotary helpers. That is an increase over last year's total employment of about 3,500 people.

About 936 of the total number of rotary contractors also produce oil or gas wells. In fact, for over half of these, their producing activities are more important than their contract-drilling activities. Of the 267 remaining contractors, most report to the Journal that they are endeavoring to develop production.

Where Are the Home Offices of the 1,203 Contractors Who Own 3,829 Rigs Located?

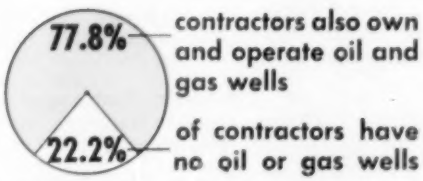
CALIFORNIA	73 Contractors own	252 Rigs
ILLINOIS	68 Contractors own	132 Rigs
KANSAS	109 Contractors own	210 Rigs
OKLAHOMA	194 Contractors own	882 Rigs
LOUISIANA	57 Contractors own	215 Rigs
TEXAS	552 Contractors own	1760 Rigs
OTHERS	150 Contractors own	378 Rigs

Where Is Concentration of HOME OFFICE CONTROL for Rigs Owned?

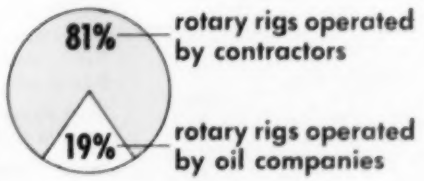
61 contractors 138 rigs	WICHITA	WICHITA FALLS	80 contractors 199 rigs
73 contractors 525 rigs	TULSA	FT. WORTH-DALLAS	73 contractors 332 rigs
52 contractors 165 rigs	OKLAHOMA CITY	SHREVEPORT	33 contractors 132 rigs
34 contractors 168 rigs	LOS ANGELES - LONG BEACH	HOUSTON	91 contractors 331 rigs
57 contractors 220 rigs	MIDLAND-ODESSA	OTHERS	649 contractors 1739 rigs

Where Were the 3,049 Superintendents and Tool Pushers Located Who Were Supervising 3,218 Rigs at Time This Census Was Made?

WEST TEXAS - NEW MEXICO	945 tool pushers	31%
TEXAS GULF COAST	335 tool pushers	11%
OKLAHOMA	487 tool pushers	16%
LOUISIANA GULF COAST	274 tool pushers	9%
ROCKY MOUNTAIN	274 tool pushers	9%
CALIFORNIA	183 tool pushers	6%



936 contractors out of 1,203 total, also own and produce oil and gas wells; for over half of these, their producing activities are more important than their contract drilling activities. Of the 267 remaining contractors, most are endeavoring to develop production.



About 19% of rotary drilling done by oil companies operating their own tools (this varies somewhat in different parts of country). As deeper drilling trend continues, oil companies assume a greater and greater share of drilling risks, hence are increasingly interested in type of equipment contractors use for them.

HERE ARE THE DRILLING REPORTS . . .

on 71 active representative fields in the United States and Canada, showing contract prices, rig-time distribution, bit data, typical equipment in use, casing and mud programs, and other useful drilling information.*

DRILLING REPORT

Rocky Mountains

ADENA FIELD
Morgan County, Colorado

Pay zone ..... "D" and "J" sands
TD (avg.) ..... "D" at 5,500 ft.; "J" at 5,625 ft.

Cost Data

Footage price	$2.90
Day-work rate with drill pipe	650.00
Day-work rate without drill pipe	600.00

Normal Rig-Time Distribution

Days on footage rate	8
Days on day-work rate	3
Total days (spud to rig release)	11

Bit Data

Total number of bits	6

Equipment

Derrick: L. C. Moore 136 ft.
Draw works: U-15.
Motors (No., hp.): Two LI 60.
Pumps: One C-250 Ideal.
Fuel: Butane.
Water supply: Well.
Nearest supply center: Fort Morgan or Brush.
Terrain and roads: Passable.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	8⅝	108	85
Oil string	5½	5,700	275

Typical Mud Properties

Interval (ft.)	0-4,600	4,600-TD
Type mud	Water	Oil-soap emulsion
Weight (lb./gal.)		9.8
Filter cake (in.)		1
Viscosity (sec.)		120
Water loss (cc.)		2.8

Mud Summary

Material—	Amount
Magcobar	
Gel	
Caustic, lb.	400
Soda ash, sacks	5
Quebracho, lb.	600
Magcophos, sacks	6

Geological Data

Formation tops—	Depth (ft.)
Niobrara	4,680
Timpas	5,040
Carlile	5,084
Greenhorn	5,156
Bentonite	5,380
"D" sand	5,500
"J" sand	5,625

*The field summaries list average data only. Drilling conditions may vary within the particular field depending upon local geology, oil company requirements, etc.

DRILLING REPORT

LITTLE BEAVER FIELD
Washington and Adams Counties, Colorado

Pay zone ..... "D" and "J" sands
TD (avg.) ..... 5,300-5,500 ft.

Cost Data

Footage price	$2.90-$3.00
Day-work rate with drill pipe	650.00
Day-work rate without drill pipe	600.00

Normal Rig-Time Distribution

Days on footage rate	8
Days on day-work rate	2
Total days (spud to rig release)	10

Bit Data

Total number of bits	5
Feet per bit	1,100

Equipment

Derrick: 127-ft. cantilever mast.
Draw works: U-15.
Motors (No., hp.): Two at 190 hp.
Pumps: One 7¼ by 14 in.
Fuel: Diesel.
Water supply: Wells.
Nearest supply center: Fort Morgan.
Terrain and roads: Fair.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	120	85
Oil string	7	5,400	275

Geological Data

Formation tops—	Depth (ft.)
Niobrara	4,400
Fort Hays	4,800
Carlile	4,840
"D" sand	5,240
"J" sand	5,320

Remarks: Relatively easy drilling to the pay sands in field wells. Some wells are completed in about 7 days.

DRILLING REPORT

BLACK HOLLOW FIELD
Weld County, Colorado

Pay zone ..... Lyons sandstone
TD (avg.) ..... 9,000 ft.
Total days (spud to rig release) 35

Equipment

Derrick: 133-ft. cantilever mast.
Draw works: Type 80.
Motors (No., hp.): 3 at 345 hp.
Pumps: 1—7¾ by 18-in. and 1—7¼ by 15-in.
Fuel: Natural gas or butane.
Water supply: Ponds or wells.
Nearest supply center: Denver.
Terrain and roads: Passable.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	690	350
Oil string	7	9,000	400

Drilling-Report Index . . .

Rocky Mountain fields . . . Adena, Little Beaver, Black Hollow, Clareton, Glenrock, Salt Creek, and West Salt Creek, Sage Creek, Beaver Creek, South Big Medicine Bow, Cabin Creek, Charlson, Tioga, White Earth, Landslide Butte, Uintah Basin, Clear Creek, Blanco.

West Texas Ellenburger fields . . . Andrews Northeast, Headlee, Magutex, Midland Farms, Pegasus, Puckett, Sara (Devonian), Triple "N", Virey and War-San (Dora Roberts Ranch area), Wemac.

West Texas and Wolfcamp fields . . . Andrews, Nolley, Parker.

West Texas and Permian basin fields . . . Central Basin Platform, Moore, Prentice, Spraberry, Fort Chadbourne, Huldale.

East Texas fields . . . Carthage, Neches, Woodlawn.

North Texas field . . . Big Mineral.

South Texas fields . . . Kuhlman-Bender, Mary Ellen O'Connor, Redfish Bay, Seligson.

Louisiana fields . . . Cotton Valley Trend, Caddo-Pine Island, East Lake Palourde, Northwest Branch.

Oklahoma fields . . . Caddo, Golden Trend, Southwest Maysville, Bradley area, Little Chief, Oconee and Centrahoma, South Frederick area, Simpson production (Cleveland County).

Hugoton Embayment fields . . . Guymon-Hugoton, Keyes Dome, Quinduno, Central Kansas Uplift.

Eastern United States fields . . . Appalachian gas area, Illinois basin.

Mississippi fields . . . Bolton, Pistol Ridge-Maxie.

Canadian fields . . . Pembina, Pigeon Lake, West Drumheller.

Geological Data

Formation tops—	Depth (ft.)
Niobrara	6,350
Timpas	7,100
Carlile	7,120
Greenhorn	7,330
Graneros	7,420
"D" sand	7,610
Skull Creek	7,730
"J" sand	7,860
Lyons sand	8,960

DRILLING REPORT

CLARETON FIELD
Weston County, Wyoming

Pay zone	Newcastle sand
TD (avg.)	6,500-7,500 ft.

Cost Data

Footage price	$3.75
Day-work rate with drill pipe	750.00
Day-work rate without drill pipe	700.00

Normal Rig-Time Distribution

Days on footage rate	15 (10 drlg. days)
Days on day-work rate	1
Total days (spud to rig release)	16

Bit Data

Total number of bits	15
Feet per bit	465

Equipment

Derrick: 131-ft. mast.
Draw works: U-15.
Motors (No., hp.): Two at 275 hp.
Pumps: One 7¾ by 15-in.
Fuel: Propane or natural gas.
Water supply: Hauling from Cheyenne River.
Nearest supply center: Newcastle.
Terrain and roads: Rough.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	200	125
Oil string	5½	6,500-7,500	200

Geological Data

Formation tops—	Depth (ft.)
Top oil sand	6,500-7,000

Remarks: Operators set pipe through pay sand and fracture through perforations, using 1,000 gal. MCA and sand-oil (10,000 lb. of sand).

DRILLING REPORT

CLARETON—CHEYENNE RIVER AREA
Weston County, Wyoming

Pay zone	Newcastle sand
TD (avg.)	7,500 ft.

Cost Data

Footage price	$4.25
Day-work rate with drill pipe	850.00
Day-work rate without drill pipe	800.00

Normal Rig-Time Distribution

Days on footage rate	22
Days on day-work rate	5
Total days (spud to rig release)	27

Bit Data

Total number of bits	21
Feet per bit	350

Equipment

Derrick: L. C. M. 126-ft. jackknife.
Draw works: G-500 Emsco.
Motors (No., hp.): Two at 350 hp., one at 225-hp.
Pumps: One 7¾ by 16-in. and one 7¼ by 12-in.
Fuel: Natural gas or butane.
Water supply: Cheyenne River.
Nearest supply center: Newcastle or Casper.
Terrain and roads: Terrain fair; dirt roads are rough.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	260	125
Oil string	5½	7,800	200

Geological Data

Formation tops—	Depth (ft.)
Newcastle sand (tops vary along trend)	7,500-7,800

Remarks: Operators set casing through pay, using guide shoe, float collar, and three centralizers. Wells are fractured with 1,000 gal. MCA and sand oil (10,000 lb. sand). Lost circulation may occur occasionally, but is not serious.

DRILLING REPORT

GLENROCK FIELD
Converse County, Wyoming

Pay zone	Muddy sandstone
TD (avg.)	7,100 ft.

Equipment

Derrick: 133-ft. Cantilever mast.
Draw works: 75-CA.
Motors (No., hp.): Two at 460 hp.
Pumps: One 7¾ by 18-in. and one 7¼ by 15-in.
Fuel: Natural gas.
Nearest supply center: Casper, Wyo.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	310	250
Oil string	7	7,100	250

Mud Summary

Material—	Amount
Fiber, sacks	10
Bentonite, lb.	42,700
Quebracho, lb.	575
Driscose, lb.	200
Caustic, lb.	190
Magcophos, lb.	75
Hulls, sacks	20

Geological Data

Formation tops—	Depth (ft.)
Teapot	1,420
Parkman	1,835
First Wall Creek	5,775
Second Wall Creek	5,870
Upper Muddy	6,830
Lower Muddy	6,850
Dakota	6,970

DRILLING REPORT

SALT CREEK AND WEST SALT CREEK
Natrona County, Wyoming

Pay zone	Second Wall Creek sand
TD (avg.)	2,700-3,000 ft.

Equipment

Derrick: 127-ft. cantilever mast.
Draw works: Unit Rig Model U-15.
Motors (No., hp.): Two 210-hp.
Pumps: One 7¾ by 15-in. and one 7¼ by 14-in.
Fuel: Natural gas or butane.
Water supply: Wells.
Nearest supply center: Casper, Wyo.
Terrain and roads: Rolling; passable dirt roads.

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	8⅝	100	50
Oil string	5½	2,700-3,000	65-100

Geological Data

Formation tops—	Depth (ft.)
First Frontier (Wall Creek)	2,275
Second Frontier (Wall Creek)	2,660

Remarks: Use float shoe and one or two centralizers on casing. Some operators use cable tools to complete and fracture producing zone.

DRILLING REPORT

SAGE CREEK FIELD
Big Horn County, Wyoming

Pay zone	Tensleep
TD (avg.)	3,600 ft.

Cost Data

Footage price	$6.25-$7.00
Day-work rate with drill pipe	700.00
Day-work rate without drill pipe	650.00

Normal Rig-Time Distribution

Days on footage rate	17
Days on day-work rate	5
Total days (spud to rig release)	22

Equipment

Derrick: 126-ft. L. C. M. cantilever mast.
Draw works: S-50, GB-500, U-34, or U-35
Motors (No., hp.): Two at 350 hp.
Pumps: One 7¾ by 16-in.; one 7¼ by 14-in.
Fuel: Natural gas.
Water supply: Irrigation ditch.
Nearest supply center: Powell, Wyo.
Terrain and roads: Good highway along edge of field; service roads fair to good. Terrain low and rolling.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	208	100
Intermediate	5½	3,520	150

Typical Mud Properties

Interval (ft.)	0-200	200-3,200	3,200-3,600
Type mud	Gel	Gel	Gel
Weight (lb./gal.)		9.7	9.8
Filter cake (in.)		3/32	2/32
Viscosity((sec.)	45	35	50
Water loss (cc.)		25	10
pH			8.5

Mud Summary

Material—	Amount (lb.)
Bentonite	12,500
Caustic	400
Quebracho	400
Driscose	150

Geological Data

Formation tops*—	Depth (ft.)
Mowry	600
Dakota	1,430
Morrison	1,600
Sundance	1,900
Gypsum Springs	2,200
Chugwater	2,850
Dinwoody	3,350
Tensleep	3,420

*Tops vary considerably.

Remarks: Drilling to the Tensleep is fairly easy with no major problems.

DRILLING REPORT

BEAVER CREEK FIELD
Fremont County, Wyoming

Pay zone	Madison
TD (avg.)	11,500 ft.

Cost Data

Footage price	$11.00
Day-work rate with drill pipe	950.00
plus 1¼ cents per foot drill pipe rental)	
Day-work rate without drill pipe	950.00

Normal Rig-Time Distribution

Days on footage rate	83
Days on day-work rate	59
Total days (spud to rig release)	150

Bit Data

Total number of bits	95
Feet per bit	120

Equipment

Derrick: 136-ft. steel derrick.
Draw works: Emsco J-1250.
Motors (No., hp.): Three at 420 hp.
Pumps: One 7¾ by 16-in., one 8 by 20-in.
Fuel: Natural gas or butane.
Nearest supply center: Casper, Wyo.
Terrain and roads; Passable; dirt.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	13⅜	250	250
Intermediate	9⅝	3,900	1,500
Oil string	7	11,500	1,800

Typical Mud Properties

Interval (ft.)	0-9,000	9,000-10,500	10,500-11,500
Type mud	Gel-chemical	Gel-chemical	Gel-chemical
Weight (lb./gal.)	10.2	10.2	10.2
Filter cake (in.)	3/32	3/32	2/32
Viscosity (sec.)	38-42	45-50	45-50
Water loss (cc.)	12-15	12-15	5-10
pH	8.5-9.0	9.0-10	11.5-12.5
Salt cont. (p.p.m.)	Negligible		

Geological Data

Formation tops—	Depth (ft.)
Steele "A"	4,000
Steele "B"	4,607
First Frontier	6,810
Muddy	7,970
Lakota	8,270
Morrison	8,340
Nugget	8,850
Chugwater	9,150
Dinwoody	10,180
Phosphoria	10,230
Tensleep	10,550
Amsden	10,990
Darwin	11,030
Madison	11,110

Remarks: Crooked hole due to steep dip may be a problem; this is corrected by reducing the weight on the bit. Considerable coring was done on early wells; day-work time on future field wells probably will be reduced.

SOUTH BIG MEDICINE BOW FIELD
Carbon County, Wyoming

Pay zone	Muudy sands, Sundance sand
TD (avg.)	6,000 ft.

Normal Rig-Time Distribution

Days on footage rate	30
Days on day work rate	13
Total days (spud to rig release)	55

Equipment

Derrick: 127-ft. L. C. M. cantilever, 8 by 40-ft. substructure.
Draw works: Unit Rig Model U-15.
Motors (No., hp.): Three NKU Waukeshas at 210 hp.
Pumps: One 7¼ by 15-in. National Ideal and one 7¼ by 14-in. FXK Gardner-Denver.
Fuel: Butane.
Water supply: Medicine Bow River.
Nearest supply center: Casper, Wyo.
Terrain and roads: Rough.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	600	450
Oil string	7	5,500	200

Typical Mud Properties

Interval (ft.)	0-3,900	3,900-TD
Type mud	Native	Oil emulsion
Weight (lb./gal.)		10
Filter cake in.)		2/32
Viscosity (sec.)		85-100
Water loss (cc.)		4
pH		10
Salt content (p.p.m.)		600

Geological Data

Formation tops—	Depth (ft.)
B. Shannon	2,553
Muddy	5,420

Remarks: Lost-circulation zone at 300 ft. and high-pressure zone at 5,420-60 ft.

DRILLING REPORT

CABIN CREEK FIELD
Fallon County, Montana

Cost Data

Footage price	$6.50
Day-work rate with drill pipe	900.00
Day-work rate without drill pipe	700-800

Normal Rig-Time Distribution

Days on footage rate	50
Days on day-work rate	14
Total days (spud to rig release)	64

Equipment

Derrick: 127-ft. cantilever mast.
Draw works: G-B-800.
Motors (No., hp.): Three at 300 hp.
Pumps: One 8 by 20-in. and one 7¾ by 16-in.
Fuel: Diesel.
Water supply: Well.
Nearest supply center: Glendive, Mont.
Terrain and roads: Rolling to hilly; roads fair to good.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	9⅝	1,000	350
Oil string	5½	8,950	1,250 (two stages)

Mud Summary

Material—	Amount (sacks)
Cantoloid	700
Dowicide	49
Brinegel	1,130
Filcom	10
Lime	7
Gypsum	63
Controlgel	192
Cottonseed hulls	100
Controlbar	4
Driscose	8
Salt	400

Geological Data

Formtion tops—	Depth (ft.)
Kibbey	6,660
Charles "A"	6,760
Stony Mountain	8,750
Red River	8,910

Remarks: Lost circulation may occur in the Charles formation as well as nitrogen gas zones.

DRILLING REPORT

CHARLSON FIELD
McKenzie County, North Dakota

Pay zone	Madison limestone
TD (avg.)	8,600-8,800 ft.

Cost Data

Footage price (all contracts on day work), est.	$6.00

Normal Rig-Time Distribution

Days on day-work rate	35-40
Total days (spud to rig release)	35-40

Equipment

Derrick: 133-ft. cantilever mast.
Draw works: National 75-CA.
Motors (No., hp.): Two at 460 hp.
Pumps: One 7¾ by 18-in. and one 7¼ by 15-in.
Fuel: Natural gas.
Nearest supply center: Williston and Tioga.
Terrain and roads: Roads muddy during spring thaw; otherwise passable.

Casing Program

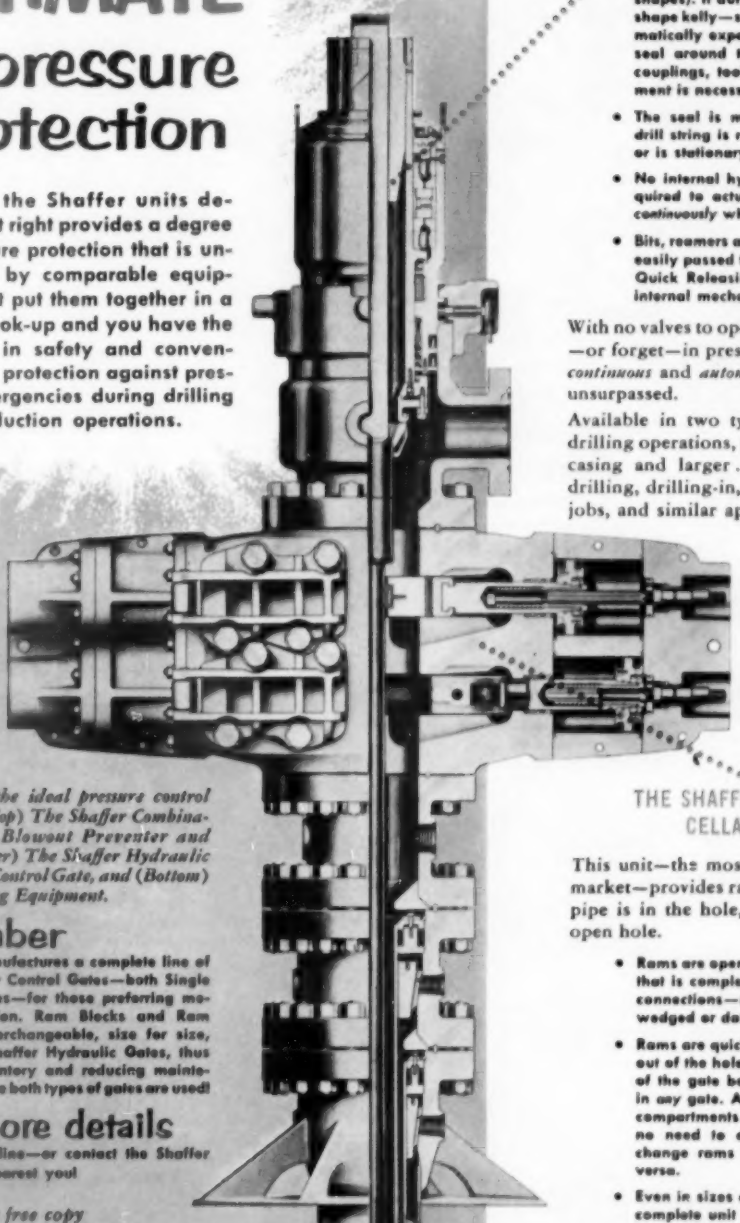
	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	600	450
Oil string	5½	8,700	1,000

Typical Mud Properties

Interval (ft.)	628-5,900	5,900-7,200	7,200-TD
Type mud	Native	Gypsum base	Sat. salt emulsion
Weight (lb./gal.)		10.5	10.3
Filter cake (in.)		2/32	3/32

For the ULTIMATE in pressure protection

Each of the Shaffer units described at right provides a degree of pressure protection that is unmatched by comparable equipment. But put them together in a single hook-up and you have the ultimate in safety and convenience for protection against pressure emergencies during drilling and production operations.



Illustrated is the ideal pressure control hook-up . . . (Top) The Shaffer Combination Rotating Blowout Preventer and Stripper, (Center) The Shaffer Hydraulic Double Cellar Control Gate, and (Bottom) Shaffer Landing Equipment.

Remember

Shaffer also manufactures a complete line of *Mechanical* Cellar Control Gates—both Single and Double types—for those preferring mechanical operation. Ram Blocks and Ram Rubbers are interchangeable, size for size, with those in Shaffer Hydraulic Gates, thus simplifying inventory and reducing maintenance costs where both types of gates are used!

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THE SHAFFER COMBINATION ROTATING BLOWOUT PREVENTER AND STRIPPER

This unit provides—in compact space—every necessary feature for efficient, simplified pressure control while the drill string is in the hole . . .

- **It *automatically* maintains a continuous seal around the different diameters and shapes in the drill string (except bits, reamers and similar abnormally large shapes). It automatically seals around pipe and any shape kelly—square, hexagon or octagon—and automatically expands and contracts to maintain a tight seal around the varying diameters of kelly, pipe, couplings, tool joints, subs, etc. No manual adjustment is necessary!**
- **The seal is maintained automatically whether the drill string is rotating—is being raised or lowered—or is stationary.**
- **No internal hydraulic or mechanical pressure is required to actuate the unit—the seal is maintained *continuously* while the drill string is in the hole.**
- **Bits, reamers and other abnormally large tools can be easily passed through the unit by merely rotating the Quick Releasing Bonnet ¼ turn and removing the internal mechanism as a unit. It's simple, quick!**

With no valves to open or close, nothing to remember—or forget—in pressure emergencies, this unit gives *continuous* and *automatic* pressure protection that is unsurpassed.

Available in two types—Type 50 for all kinds of drilling operations, including drilling through 10¾" casing and larger . . . and Type 51 for slim hole drilling, drilling-in, re-work operations, production jobs, and similar applications.

THE SHAFFER HYDRAULIC DOUBLE CELLAR CONTROL GATE

This unit—the most advanced Control Gate on the market—provides rams for shutting off the well when pipe is in the hole, as well as rams for sealing off open hole.

- **Rams are opened and closed by *direct* hydraulic drive that is completely enclosed. No yokes or secondary connections—no exposed moving parts to become wedged or damaged.**
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- **Even in sizes as large as 13⅝" (12" Series 900) the complete unit (including *two* ram compartments) requires only 30" cellar height—smaller sizes even less. What's more, these compact dimensions are *fixed*—there's no need to allow extra space at the ends for expanding the gate to change rams . . . nor is extra space required above the gate to replace the rams. Shaffer compactness is *real* compactness!**
- **With Shaffer Gates, the same compact design is equally efficient for either low or high pressure operations. There's no need to choose between compactness and full pressure protection. The same basic Shaffer design gives BOTH!**

There are many other advancements built into Shaffer Hydraulic Double Cellar Control Gates—and the same features are also available in a complete range of Shaffer Hydraulic *Single* Cellar Control Gates for those preferring this type of installation.

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See the Shaffer Section of your latest Composite Catalog.

Viscosity (sec.)	47	60
Water loss (cc.)	17.0	9.4
pH	6.0	6.0
Salt content (p.p.m.)	206,000	306,000

Mud Summary

Estimated mud costs are about $7,300.

Geological Data

Formtion tops—	Depth (ft.)
Niobrara	3,400
Greenhorn	3,800
Newcastle	4,300
Dakota	4,690
Morrison	4,940
Swift	5,130
Piper limestone	5,465
Gypsum Spring	5,810
Charles	7,890
Last salt	8,500
Madison limestone	8,570

Remarks: Operators use a 1:1 Pozmix cement on casing all wells; recently they changed to a saturated salt mud. Wells are completed through perforations after acidizing, usually with 2,000 gal. Bit requirements are similar to those of Tioga and White Earth.

DRILLING REPORT

TIOGA FIELD
Williams County, North Dakota

Pay zone	Madison limestone
TD (avg.)	8,200 ft.

Cost Data

Footage price (all contracts on day work), est.	$6.00

Normal Rig-Time Distribution

Days on day-work rate	30
Total days (spud to rig release)	30

Bit Data

Total number of bits	25
Feet per bit	330

Equipment

Derrick: 133-ft. cantilever mast.
Draw works: Super 7-11.
Motors (No., hp.): Three at 400 hp.
Pumps: One 7¾ by 18-in. and one 7¼ by 15-in.
Fuel: Natural gas.
Water supply: Wells.
Nearest supply center: Williston and Tioga.
Terrain and roads: Rolling prairie; spring thaws make roads very muddy, otherwise passable.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	600	400
Oil string	5½ or 7	8,200	900-1,150

Typical Mud Properties

Interval (ft.)	600-6,000	6,000-7,000	7,000-TD
Type mud	Native	Sat. salt emulsion	Sat. salt emulsion
Weight (lb./gal.)		10.7	10.6
Filter cake (in.)		2/32	2/32
Viscosity (sec.)		75	69
Water loss (cc.)		9.7	8.0
pH		6.5	6.0
Salt content (p.p.m.)		304,000	314,000

Mud Summary

Material—	Amount
Aquagel, lb.	1,900
Tannex, lb.	250
Caustic soda, lb.	100
Barafos, lb.	200
Gypsum, lb.	3,000
Lignox, lb.	4,850
Zeogel, lb.	3,100
Salt, lb.	185,000
Impermix, lb.	15,000
Pres No. 5	800
Defoamer	13
Total mud cost	$7,287

Geological Data

Formtion tops—	Depth (ft.)
Pierre	1,760
Greenhorn	4,080
Newcastle	4,500
Dakota	4,770
Morrison	5,180
Ellis	5,360
Spearfish	6,150
Amsden	6,680
Kibbey	7,160
Charles salt	7,450
Madison limestone	8,040

DRILLING REPORT

WHITE EARTH FIELD
Mountrail County, North Dakota

Pay zone	Madison
TD (avg.)	8,200 ft.

Cost Data

Footage price (all contracts on day rate), est.	$6.00

Normal Rig-Time Distribution

Days on day-work rate	30-35
Total days (spud to rig release)	30-35

Bit Data

Total number of bits	27
Feet per bit	310

Equipment

Derrick: 133-ft. cantilever mast.
Draw works: National 80-U.
Motors (No., hp.): Three at 345 hp.
Pumps: One 7¾ by 18-in. and one 7½ by 15-in.
Fuel: Gas or butane.
Nearest supply center: Williston and Tioga.
Terrain and roads: Rolling prairie roads muddy in spring.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	622	525
Oil string	5½	8,200-8,400	750

Typical Mud Properties

Interval (ft.)	600-5,900	5,900-7,000	7,000-TD
Type mud	Native	Sat. salt emulsion	Sat. salt emulsion
Weight (lb./gal.)		10.7	10.5
Filter cake (in.)		2/32	2/32
Viscosity (sec.)		51	60
Water loss (cc.)		9.0	9.1
pH		6.0	6.0
Salt content (p.p.m.)		291,060	312,000

Mud Summary

Material—	Amount
Aquagel, lb.	1,900
Tannex, lb.	250
Caustic soda, lb.	100
Barafox, lb.	200
Gypsum, lb.	3,000
Lignox, lb.	4,850
Zeogel, lb.	3,100
Salt, lb.	185,000
Impermex, lb.	15,000
Pres No. 5, lb.	800
Defoamer	13
Average total mud cost	$7,287

Geological Data

Formtion tops—	Depth (ft.)
Pierre	1,960
Greenhorn	4,315
Newcastle	4,740
Dakota	5,010
Morrison	5,400
Ellis	5,540
Piper limestone	6,080
Spearfish	6,300
Amsden	6,910
Kibbey	7,400
Charles salt	7,690
Madison limestone	8,230

Remarks: Operators are now using a salt-saturated mud through the evaporite section from about 6,000 ft. to total depth. Recent field wells with collapsed casing are a serious problem that may be eliminated by the use of the salt-saturated mud. Contractors have used jet bits with success, but current trend is to cut down on their use through the evaporite section and drill with conventional bits.

DRILLING REPORT

LANDSLIDE BUTTE AREA
Glacier County, Montana

Pay zone	Banff limestone
TD (avg.)	5,800 ft.

Cost Data

Footage price	$10.00
Day-work rate with drill pipe	700.00
Day-work rate without drill pipe	650.00

Normal Rig-Time Distribution

Days on footage rate	45½
Days on day-work rate	26½
Total days (spud to rig release)	72

Equipment

Derrick: 133-ft. cantilever mast.
Draw works: 75-CA Consolidated.
Motors (No., hp.): Two at 460 hp.
Pumps: One 7¾ by 18-in., and one 7¼ by 15-in.
Fuel: Natural gas or butane.
Nearest supply center: Cut Bank.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	590	330
Oil string	5½	5,885	335

Geological Data

Formation tops—	Depth (ft.)
Eagle	1,770
Colorado	1,940
Blackleaf	3,100
Madison	4,690
Exshaw	5,830

Remarks: Operators used float collar and float shoe on oil string with eight centralizers and 350 ft. of Roto wall cleaners.

DRILLING REPORT

UINTA BASIN AREA
Uintah County, Utah

Pay zone	Green River
TD (avg.)	8,500 ft.

Cost Data

Footage price	$11.00
Day-work rate with drill pipe	1,040.00
Day-work rate without drill pipe	925.00

Normal Rig-Time Distribution

Days on footage rate	65
Days on day-work rate	67
Total days (spud to rig release)	132

Equipment

Derrick: Jackknife.
Draw works MC-450 or National 75.
Motors (No., hp.): Three at 325 hp.
Pumps: Two 7¾ by 18-in.
Fuel: Natural gas, diesel, or butane.
Water supply: Well or hauled by truck.
Nearest supply center: Vernal, Utah; Artesia, Craig, Colo.
Terrain and roads: Passable but rough.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	600	300
Oil string	7	8,500	350

Typical Mud Properties

Interval (ft.)	0-4,000	4,000-8,500
Type mud	Gel	Gel
Weight (lb./gal.)	9.3	10
Filter cake (in.)	2/32	2/32
Viscosity (sec.)	36	44
Water loss (cc.)	35	30

Mud Summary

Material—	Amount
Weight material, lb.	400,000
Gel, lb.	125,000
Thinners, lb.	25,000
Lost-circulation material, lb.	40,000
Water loss, lb.	1,000

Geological Data

Formation tops—	Depth (ft.)
Top oil sand	8,400

Remarks: Lost circulation and possible blowouts may be a problem, although these are not difficult to overcome. Drilling conditions are highly variable in the Uinta basin.

DRILLING REPORT

CLEAR CREEK FIELD
Carbon County, Utah

Pay zone	Ferron sand
TD (avg.)	4,500-6,500 ft. (With surface elevations between 8,000-10,000 ft.)

Cost Data

Footage price	Company rigs; data not available

Normal Rig-Time Distribution

Days on footage rate	49
Days on day-work rate	14
Total days (spud to rig release)	75

Equipment

Derrick: Jackknife, 127 ft.
Draw works: Unit U-10, U-15 or equivalent.
Motors (No., hp.): Two 250-hp.
Pumps: One 14 by 7¼-in.
Fuel: Diesel.
Water supply: Springs and streams.
Nearest supply center: Price, Utah.
Terrain and roads: Mountainous terrain; dirt roads.

Geological Data

Formation tops—	Depth (ft.)
Ferron sand (top of pay sand variable)	4,000-6,000

Remarks: Many wells have had severe lost-circulation problems due to fractures in the first 4,000 ft. of hole. Both mud and gas are used to drill the pay section.

DRILLING REPORT

BLANCO FIELD
Rio Arriba County, New Mexico

Pay zone	Mesaverde
TD (avg.)	6,025 ft.

Equipment

Derrick: 127-ft. cantilever mast.
Draw works: 75 consolidated.
Motors (No., hp.): Three at 210 hp.
Pumps: One 7¼ by 15-in. and one 7¼ by 14-in.
Fuel: Gas or butane.
Nearest supply center: Farmington.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	9⅝ or 10¾	160-320	150-200
Oil string	7	5,300	400 (Cement in two stages)

Typical Mud Properties

Interval (ft.)	600-1,500	1,500-5,300	5,300-TD
Type mud	Clear water		
Weight (lb./gal.)		9.6	11.5
Filter cake (in.)		2/32	2/32
Viscosity (sec.)		50	50
Water loss (cc.)		8-9	8-9
pH		8½	8½
Salt content (p.p.m.)		150-200	150-200

Mud Summary

Material—	Amount
Gel	500
Weighting material (if necessary)	1,000
Hulls	300
Fiber	400
Quebracho	1,500
Caustic soda	500
Soda ash	2,500

Geological Data

Formation tops— (Tops vary considerably depending on well location)	Depth (ft.)
Kirtland	2,750
Fruitland	2,910
Pictured Cliffs	3,140
Lewis	3,300
Cliffhouse sand	5,040
Menefee shale	5,080
Point Lookout	5,280

Remarks: High-pressure gas occurs in some areas in the Fruitland and Pictured Cliffs formations and operators weight mud to combat these zones, usually found between 3,100-3,600 ft. Lost circulation may occur in the Lewis shale at 4,700-5,300 ft. Producing Mesaverde formation is drilled with gas as the circulating fluid instead of mud.

DRILLING REPORT

West Texas

ANDREWS NORTHEAST (ELLENBURGER) FIELD
Andrews County, Texas

Pay zone	Ellenburger
TD (avg.)	1,830 ft.

Cost Data

Footage price (plus chert clause)	$11.00
Day-work rate with drill pipe	1,100.00
Day-work rate without drill pipe	925.00

Normal Rig-Time Distribution

Total days (spud to rig release)	90-100

Bit Data

Total number of bits	130
Feet per bit	110

Equipment

Derrick: 136-ft. steel derrick
Draw works: National 125.
Motors (No., hp.): Three at 500 hp.
Pumps: Two C-250's 7¾ in. by 18 in.
Fuel: Diesel.
Water supply: Wells.
Nearest supply center: Odessa.
Terrain and roads: Passable.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	13⅜	230	250
Intermediate	8⅝ or 9⅝	5,300	3,250
Oil string	5½	13,830 TD	2,050

Typical Mud Properties

Interval (ft.)	1,650-5,300	5,300-10,000	10,000-TD
Type mud	Sat. salt	Water	Driscose
Weight (lb./gal.)	9.4	8.3	9.4
Viscosity (sec.)	37	30	42
Water loss (cc.)	30-40		12
Salt cont. (p.p.m.)	saturated		

Mud Summary

Material—	Amount (lb.)
Bentonite	97,500
Salt clay	25,000
Driscose	2,320
Chemicals and salt	84,900

Geological Data

Formation tops—	Depth (ft.)
Rustler	2,160
Anhydrite	3,020
Yates	3,270
Grayburg	4,680
San Andres	5,090
Clear Fork	7,070
Spraberry	8,570
Wolfcamp	9,380
Strawn	10,890
Bend	11,120
Woodford	12,400

Devonian	12,480
Silurian	12,640
Fusselman	13,250
Simpson	13,660
Ellenburger	13,800

Remarks: Occasionally lost circulation occurs between 4,500-5,000 ft. Centralizers are used on the intermediate and oil string with no scratchers.

DRILLING REPORT

DEEP ROCK (ELLENBURGER) FIELD
Andrews County, Texas

Pay zone	Ellenburger
TD (avg.)	12,300 ft.

Cost Data

Footage price	$11.50
Day-work rate with drill pipe	1,000.00
Day-work rate without drill pipe	900.00

Normal Rig-Time Distribution

Days on footage rate	88
Days on day-work rate	22
Total days (spud to rig release)	110

Bit Data

Total number of bits	104
Feet per bit	118

Equipment

Derrick: Standard L. C. Moore 136-ft. derrick, 800,000-lb. test.
Draw works: National 75.
Motors (No., hp.): Three Superiors at 350 hp.
Pumps: Ideal C-350.
Fuel: Natural gas.
Water supply: Local.
Nearest supply center: Andrews, Tex.
Terrain and roads: Level and sandy.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	13⅜	342	450
Intermediate	9⅝	4,507	2,900
Oil string	5½	12,294	1,700

Typical Mud Properties

Interval (ft.)	0-4,500	4,500-8,500	8,500-TD (12,300)
Type mud	Nat. red bed mud	Clear water	Oil emulsion mud
Weight (lb./gal.)			9.0
Filter cake (in.)			2/32
Viscosity (sec.)			60 to 100
Water loss (cc.)			6 to 10

Geological Data

Formation tops—	Depth (ft.)
Wolfcamp	8,480
Fusselman	11,100
Simpson	11,600
Ellenburger	12,160

DRILLING REPORT

HEADLEE FIELD
Ector County, Texas

Pay zone	Ellenburger
TD (avg.)	13,500 ft.

Cost Data

Footage price	$9.25-9.50
Day-work rate with drill pipe (sliding scale)	$800-$1,100

Normal Rig-Time Distribution

Total days (spud to rig release)	100-120

Bit Data

Total number of bits	120

Equipment

Derrick: 136-ft. Lee C. Moore steel derrick.
Draw works: 850,000-lb. capacity (J-1000 with J-1250 transmission).
Motors (No., hp.): Eight G.M.C., 71 diesels.
Pumps: One C-250 Ideal and one 7¼ by 12-in. Clark Triplex plus one auxiliary.
Fuel: Diesel.
Water supply: Wells.
Nearest supply center: Odessa.
Terrain and roads: Open prairie.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	13⅜	240	225
Intermediate	8⅝	5,975	*475
Oil string	5½	13,200	†1,000

Geological Data

Formation tops—	Depth (ft.)
Rustler	1,690
Yates	1,750
San Andres	4,700
Spraberry	8,060
Dean	9,040
Strawn	9,910
Bend	10,320
Mississippian	11,137
Woodford	11,480
Devonian	11,570
Silurian	12,310
Fusselman	12,460
Montoya	12,550
Simpson	12,740
Joins	13,120
Ellenburger	13,170

*1:1 Perlite; 200 neat. †1:1 Perlite with 4 per cent gel; 200 neat.

Remarks: Operators set 5½-in. casing on top of the Ellenburger pay with centralizers only, and then drill to total depth, about 200 ft. into the pay. Wells are acidized with 1,000-7,000 gal. prior to completion.

DRILLING REPORT

MAGUTEX FIELD
Andrews County, Texas

Pay zone	Devonian and Ellenburger
TD (avg.)	13,900 ft.

Cost Data

Footage price	$11
Day-work rate with drill pipe	$975-$1,175
Day-work rate without drill pipe	$875-$1,025

Normal Rig-Time Distribution

Days on footage rate	100
Days on day-work rate	40
Total days (spud to rig release)	*140

Bit Data

Total number of bits	90
Feet per bit	155

Equipment

Derrick: 136-ft. steel derrick.
Draw works: 12,000-ft. class.
Motors (No., hp.): Three 400-hp. or four 300-hp.
Pumps: Two 7¾ by 18 in.
Fuel: Gas.
Water supply: Wells.
Nearest supply center: Fullerton, Tex.
Terrain and roads: Flat; pavement.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	13⅜	400	400
Intermediate	9⅝ & 7⅝	5,000 & 12,800	3,000 & 1,300
Oil string	5½	13,900	200

Typical Mud Properties

Interval (ft.)	0-5,000	5,000-10,000	10,000-TD
Type mud	Water	Water	C-Q-E
Weight (lb./gal.)			9.2
Viscosity (sec.)			40-75
Water loss (cc.)			10
pH			10
Salt cont. (p.p.m.)	Salt sat.	Fresh	

Mud Summary

Material—	Amount
Gel, sacks	200
Caustic, lb.	1,000
Quebracho, lb.	1,000
Oil, bbl.	300

Geological Data

Formation tops—	Depth (ft.)
Anhydrite	2,110
Yates	3,240
Grayburg	4,720
Spraberry	8,490
Wolfcamp	9,800
Strawn	10,950
Bend	11,330
Woodford	12,460
Devonian	12,540
Montoya	13,420
Simpson	13,670
Ellenburger	13,830

*Recent wells are completed in 90 days or less.

Remarks: Some operators drill and complete Magutex wells in 80-90 days to 13,900 ft. Four strings of casing are often used, including the 5½-in. liner from 12,800 to TD instead of the usual three strings. Purpose of the additional string is to protect the Devonian. Lost circulation at 5,000 ft. in the San Andres gives some trouble. Operators drill through the pay and set pipe on bottom. Wells are acidized selectively, using as much as 20,000 gal. of regular acid.

DRILLING REPORT

MIDLAND FARMS (ELLENBURGER) FIELD
Andrews County, Texas

Pay zone	Ellenburger
TD (avg.)	12,700 ft.

Cost Data

Footage price	$8.50-9.00
Day-work rate with drill pipe (plus 1½ cents per ft. drill-pipe rental)	935.00
Day-work rate without drill pipe	935.00

Normal Rig-Time Distribution

Days on footage rate	73
Days on day-work rate	16
Total days (spud to rig release)	89

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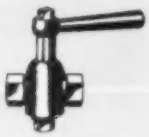

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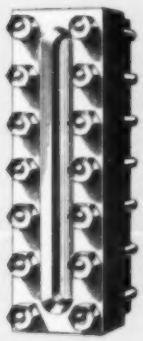

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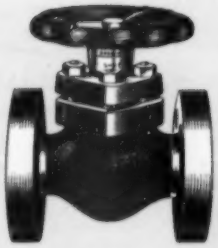

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Bit Data

Total number of bits	100
Feet per bit	130

Equipment

Derrick: 136-ft. L. C. Moore steel derrick
Draw works: J-1000.
Motors (No., hp.): Three LR2U's at 460 hp.
Pumps: One C-350 and one triple 7¼ in. by 12 in. plus one auxiliary.
Fuel: Diesel.
Water supply: Wells.
Nearest supply center: Odessa.
Terrain and roads: Flat, ranch country.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	13⅜	270	265
Intermediate	9⅝	4,900	380 +3,600
Oil string	5½	12,700	400

Typical Mud Properties

Interval (ft.)	0-270	270-4,900	4,900-TD
Type mud	Nat.	Nat.	(*)

Geological Data

Formation tops—	Depth (ft.)
Wolfcamp	8,340
Pennsylvanian	9,690
Bend	10,120
Mississippian	10,490
Woodford	10,870
Devonian	10,920
Fusselman	11,950
Montoya	12,000
Joins	12,620
Ellenburger	12,670

*Mud up with gel chemical mud at contractor's discretion.

Remarks: No serious drilling problems; occasionally hole deviation occurs while trying to maintain maximum penetration rate. Operators set on top of pay in center of field and through pay on the flanks. Centralizers and scratchers are placed on joints through the pay and 100 ft. above pay. Minimum stimulation gives high-potential wells. Typical treatment consists of 3,000-5,000 gal. of regular acid followed by a 3,000-5,000-gal. acidfrac if necessary.

DRILLING REPORT

PEGASUS (ELLENBURGER) FIELD
Upton County, Texas

Pay zone	Ellenburger
TD (avg.)	13,200 ft.

Cost Data

Footage price	$11
Day-work rate with drill pipe	$975-1,175
Day-work rate without drill pipe	$875-1,025

Normal Rig-Time Distribution

Days on footage rate	74
Days on day-work rate	24
Total days (spud to rig release)	98

Bit Data

Total number of bits	178
Feet per bit	75

Equipment

Derrick: 136-ft. steel derrick.
Draw works: National 80-B.
Motors (No., hp.): Three LR2U Waukeshas at 460 hp.
Pumps: One 7¼ by 18 in. National Ideal C-350 and one 7¼ by 13-in. National Ideal C-250.
Fuel: Gas.
Water supply: Ponds and wells.
Nearest supply center: Odessa.
Terrain and roads: Passable; flat; pavement.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	13⅜	450	(*)
Salt string	8⅝	4,800	(*)
Oil string	5½	13,200	(†)

Typical Mud Properties

Interval (ft.)	0-400	400-4,800	4,800-13,200
Type mud	Spud	Salt gel	Emulsion
Weight (lb./gal.)		8.8-9	8-9
Filter cake (in.)		3/32	3/33
Viscosity (sec.)		34	40
Water loss (cc.)		30	10
pH		8	10
Salt cont. (p.p.m.)		saturated	low

Mud Summary

Material—	Costs
Chemicals	$6,000
Gel	6,000
Lost circulation material	9,000
Total mud costs	$21,000

Geological Data

Formation tops—	Depth (ft.)
Permian	1,560
Anhydrite	1,770
Yates	2,620
Grayburg	4,440
Spraberry	7,660
Wolfcamp	9,220
Pennsylvanian	10,300
Strawn	10,890
Woodford	11,450
Devonian	11,570
Fusselman	12,300
Simpson	12,520
Ellenburger	12,920

*Circulate to surface. †Cement to base of 8⅝-in. casing.

Remarks: Lost-circulation zones are found between 7,500 and 8,500 ft. Some operators set four strings of casing, landing a protection string at 9,300 ft. and run 5½ in. liner to top of pay. Intermediate string is cemented in two stages and checked by temperature survey after each job. Many operators today complete in open hole and acidize Ellenburger with 1,000-5,000 gal. in several stages.

DRILLING REPORT

PUCKETT FIELD
Pecos County, Texas

Pay zone	Ellenburger
TD (avg.)	14,500 ft.

Equipment

Derrick: 136-ft. steel derrick.
Draw works: 1350-S.
Motors (No., hp.): 1,600-hp. total.
Pumps: Two 7¾ by 18 in. (C-350's).
Fuel: Diesel.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	13¾	1,000	(*)
Intermediate	8⅝	7,600	(*)
Oil string	5½	13,400	(†)

Typical Mud Properties

Interval (ft.)	7,000-7,600	7,600-10,600	10,600-TD
Type mud		Water	
Weight (lb./gal.)	9		10.5-11
Filter cake (in.)	3/32		3/32
Viscosity (sec.)	40		50
Water loss (cc.)	20		10
pH	10		10
Salt cont. (p.p.m.)	Low		Low

Mud Summary

Material—	Cost
Chemicals	$10,300
Gel and weighting material	11,800
Lost-circulation material	2,000
Total mud cost	$24,100

Geological Data

Formation tops—	Depth (ft.)
Yates	1,050
Grayburg	1,745
San Andres	2,290
Clearfork	2,890
Wolfcamp	5,060
Woodford	11,290
Devonian	11,400
Montaya	11,610
Simpson	12,270
Ellenburger	13,600

*Circulate to surface. †Cement to base of intermediate string.

Remarks: Lost-circulation zone at 400 to 1,000 ft. is cavernous and drilled without returns; zones between 1,800 and 4,800 ft. are drilled, using lost-circulation material. High-pressure zones with low volume are encountered between 8,500 and 11,000 ft. and hard sand from 7,600 to 8,500 ft. Mud weight of 10.5 lb. per gal. is used to control the Devonian and Ellenburger. Operators set casing on top of the Ellenburger and treat the open hole with 5,000 to 20,000 gal. of acid.

DRILLING REPORT

SARA FIELD
Gaines County, Texas

Pay zone	Devonian
TD (avg.)	12,250 ft.

Cost Data

Footage price	$9.50
Day-work rate with drill pipe (plus drill-pipe rental)	1,000
Day-work rate without drill pipe	1,000

Normal Rig-Time Distribution

Days on footage rate	93
Days on day-work rate	24
Total days (spud to rig release)	117

Equipment

Derrick: 133-ft. cantilever mast.
Draw works: National 80-B.
Motors (No., hp.): Three at 460 hp.
Pumps: One 7¼ by 18 in. and one 7¼ by 15 in.
Fuel: Gas or butane.
Water supply: Wells.
Nearest supply center: Odessa.
Terrain and roads: Flat ranch country.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	12⅜	226	250
Salt string	9⅝	5,069	3,700
Oil string	7	12,185	1,275

Typical Mud Properties

Interval (ft.)	226-5,000	5,000-9,000	9,000-TD
Type mud	Nat.	Water	(*)
Weight (lb./gal.)			9.5
Filter cake (in.)			2/32
Viscosity (sec.)			45-50
Water loss (cc.)			10-15

*Gel chemical—15 per cent oil emulsion.

DRILLING REPORT

TRIPLE "N" (ELLENBURGER) FIELD
Andrews County, Texas

Pay zone	Ellenburger
TD (avg.)	12,800 ft.

Cost Data

Footage price	$9.00
Day-work rate with drill pipe	1,100.00
Day-work rate without drill pipe	900.00

Normal Rig-Time Distribution

Total days (spud to rig release)	100-120

Bit Data

Total number of bits	130
Feet per bit	100

Equipment

Derrick: 136-ft. steel derrick.
Draw works: Emsco J-100.
Motors (No., hp.): Three at 420 hp.
Pumps: One 7¾ by 16 in. and one 7¾ by 18 in. plus auxiliary.
Fuel: Natural gas or butane.
Water supply: Wells.
Nearest supply center: Odessa.
Terrain and roads: Ranch country.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	13⅜	350	300
Intermediate	9⅝	4,400	(*)
Oil string	7	12,800	†550

Geological Data

Formation tops—	Depth (ft.)
Anhydrite	1,870
Yates	2,960
Grayburg	4,200
San Andres	4,430
San Angelo	5,630
Clear Fork	6,350
Base of Permian	8,690
Pennsylvanian	8,790
Strawn	8,950
Mississippian	9,920
Woodford	10,390
Devonian	10,510
Silurian	11,040
Fusselman	11,620
Montoya	11,720
Simpson	11,990
Ellenburger	12,500

*Circulate with 6 per cent gel cement. †4 per cent.

Remarks: Operators set 7-in. through the Ellenburger, perforate and wash the pay zone with 500 gal. of regular acid. Scratchers and centralizers are used on the oil strings.

VIREY AND WAR-SAN (DORA ROBERTS RANCH AREA) FIELD
Midland County, Texas

Pay zone	Ellenburger
TD (avg.)	13,400 ft.

Cost Data

Footage price	$8.95-9.50
Day-work rate with drill pipe (sliding scale below 11,000 ft.)	950-1,050
Day-work rate without drill pipe (sliding scale below 11,000 ft.)	850-950

Normal Rig-Time Distribution

Days on footage rate	101
Days on day-work rate	25
Total days (spud to rig release)	126

Bit Data

Total number of bits	140
Feet per bit	95

Equipment

Derrick: 136-ft. standard.
Draw works: Bethlehem 950.
Motors (No., hp.): Four at 300 hp.
Pumps: Two 20-in.
Fuel: Butane.
Water supply: Wells.
Nearest supply center: Odessa.
Terrain and roads: Ranch country.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	13⅜	330	350
Intermediate	9⅝	4,900	2,000
Oil string	5½	13,380	550 (4%) 100 neat

Typical Mud Properties

Interval (ft.)	1,600-4,875	4,875-9,178	9,178-TD
Type mud	Salt	Water	Gel and chem. mud
Weight (lb./gal.)			9.6
Filter cake (in.)			2/32
Viscosity (sec.)			40 to 90
Water loss (cc.)			8-12
pH			10-11
Salt cont. (p.p.m.)	220,000-260,000		

Mud Summary

Material—	Amount
Weight material, sacks	1,715
Gel, sacks	1,935
Soda ash, lb.	4,900
Caustic soda, lb.	4,400
Quebracho, lb.	5,400
Lost-circulation material, sacks	354

Geological Data

Formation tops—	Depth (ft.)
Gray	4,620
Spraberry	7,840
Dean	8,950
Strawn	9,910
Mississippi lime	11,190
Woodford	11,250
Devonian	11,350
Silurian	12,130
Fusselman	12,220
Simpson	12,470
Ellenburger	13,020

Remarks: Operators drill to 4,900 ft. with salt water and the degree of saturation determines the amount of washout. Lost circulation may occur in the Pennsylvanian section between 5,000 and 10,000 ft. It is necessary at times to run a liner through these zones. Operators have been setting pipe on top of the Ellenburger and drilling about 35 ft. into the pay. Open hole is treated with acid in several stages, using as much as 21,000 gal.

DRILLING REPORT

WEMAC FIELD
Andrews County, Texas

Pay zone	Ellenburger
TD (avg.)	13,700 ft.

Equipment

Derrick: 136-ft. steel derrick.
Draw works: J-1000.
Motors (No., hp.): Eight G.M. 6-17 diesels.
Pumps: One C-250 and one 7¼ by 12-in. Triplex.
Fuel: Diesel.
Water supply: Wells.
Nearest supply center: Odessa, Tex.
Terrain and roads: Ranch country.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	13⅜	210	200
Intermediate	8⅝	4,850	2,500 (4%)
Oil string	5½	13,700	1,500

Geological Data

Formation tops—	Depth (ft.)
Anhydrite	1,980
Yates	3,210
Grayburg	4,600
Glorietta	5,886
Clear Fork	6,950
Dean	8,440
Wolfcamp	8,560
Pennsylvanian	9,550
Strawn	10,050
Woodford	11,490
Devonian	12,560
Fusselman	12,530
Montoya	12,700
Simpson	12,930
Ellenburger	13,250

Remarks: Centralizers are used on both intermediate and oil string. Operators drill through the Ellenburger pay section, set pipe on bottom, and test. Common practice is to perforate the pay intervals and treat with acid as required (1,000-4,000 gal. of regular or mud acid).

DRILLING REPORT

ANDREWS (WOLFCAMP) FIELD
Andrews County, Texas

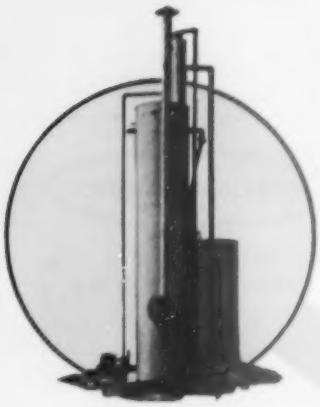
Pay zone	Wolfcamp
TD (avg.)	8,600 ft.

Cost Data

Footage price	$6.00
Day-work rate with drill pipe	800.00
Day-work rate without drill pipe	700.00

Equipment

Derrick: 136-ft. steel derrick.
Draw works: M-10,000.
Motors (No., hp.): Two LRO's.
Pumps: One C-250 and one 7¼ by 12-Triplex plus one auxiliary.



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Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	13⅜	300	300
Intermediate	9⅝	4,900	*1
Oil string	5½	8,600	†300

Geological Data

Formation tops—	Depth (ft.)
Top Wolfcamp pay	8,550

*Cubic foot of cement per foot of hole.
†Four per cent gel.

Remarks: Lost circulation may occur in the San Andres at 4,600 to 4,700 ft. Centralizers are used on intermediate and long strings. Production string is set through the pay and perforated. Operators treat the Wolfcamp with acid prior to completions.

DRILLING REPORT

NOLLY (WOLFCAMP) FIELD
Andrews County, Texas

Pay zone ..... Wolfcamp
TD (avg.) ..... 9,100 ft.

Normal Rig-Time Distribution

Total days (spud to rig release) 60

Equipment

Derrick: 126-ft. cantilever mast.
Draw works: National 80-B.
Motors (No., hp.): Three LR2U's at 460 hp.
Pumps: One C-250 7¼ by 18-in. and one C-250 7¼ by 15-in.
Fuel: Natural gas or butane.
Water supply: Wells.
Nearest supply center: Odessa.
Terrain and roads: Ranch country; roads dirt, but passable.

Cacing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	350	350
Intermediate	7⅝	4,950	2,500 (4% gel)
Oil string	5½	9,100	200

Geological Data

Formation tops—	Depth (ft.)
Anhydrite	2,230
Yates	3,400
Yoakum	4,520
San Andres	5,170
Wichita	7,980
Lower Spraberry	8,500
Wolfcamp	9,100
Bend	11,410
Mississippian	11,860
Woodford	12,370
Devonian	12,440
Fusselman	13,400
Montoya	13,480
Simpson	13,720
Ellenburger	13,970

Remarks: Operators set pipe on bottom, perforate and test the Wolfcamp. The pay zone is treated with acid in stages, using from 10,000 to 25,000-gal. total. On some wells as much as 100,000 gal. of acid has been used. Centralizers are used on intermediate and oil strings, but no scratchers.

DRILLING REPORT

PARKER (WOLFCAMP) FIELD
Andrews County, Texas

Pay zone ..... Wolfcamp
TD (avg.) ..... 8,600 ft.

Cost Data

Footage price $7.50
Day-work rate with drill pipe 850.00
Day-work rate without drill pipe 750.30

Normal Rig-Time Distribution

Total days (spud to rig release) 50-60

Bit Data

Total number of bits 60
Feet per bit 140

Equipment

Derrick: 133-ft. cantilever mast.
Draw works: National 75-CA.
Motors (No., hp.): Two at 460 hp.
Pumps: One 7¾ by 18-in. and one 7¼ by 15-in.
Fuel: Natural gas.
Water supply: Wells.
Nearest supply center: Odessa.
Terrain and roads: Passable.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	13⅜	300	300
Intermediate	9⅝	4,900	*1
Oil string	5½	8,600	†300

Geological Data

Formation tops—	Depth (ft.)
Anhydrite	1,970
Yates	3,200
San Andres	4,610
Glorietta	5,500
Wichita Albany	7,690
Wolfcamp	8,450

*Cubic foot of cement per foot of hole using perlite or fly ash. †Four per cent gel.

Remarks: Crooked holes are a problem below 7,400 ft. and slow down drilling time. Lost circulation occasionally in the San Andres at 4,600 to 4,700 ft. gives some trouble. Operators set pipe through the Wolfcamp pay, perforate and treat with regular acid before completing.

DRILLING REPORT

CENTRAL BASIN PLATFORM
Lea County, New Mexico

TD (avg.) ..... 9,250 ft.

Cost Data

Footage price $7.70
Day-work rate with drill pipe 950.00
Day-work rate without drill pipe 800.00

Normal Rig-Time Distribution

Days on footage rate 40
Days on day-work rate 70
Total days (spud to rig release) 110

Equipment

Derrick: 133-ft. cantilever mast.
Draw works: National 80-B.
Motors (No., hp.): Three LR2U's at 460 hp.
Pumps: One C-350 7¼ by 18-in. and one C-250 7¼ by 15-in.
Fuel: Natural gas or butane.
Nearest supply center: Hobbs, N. M.
Terrain and roads: Passable.

DRILLING REPORT

MOORE FIELD
Howard County, Texas

Pay zone ..... San Andres
TD (avg.) ..... 3,200 ft.

Normal Rig-Time Distribution

Total days (spud to rig release) 14

Equipment

Derrick: 96-ft. cantilever mast.
Draw works: H-30 (3,000 to 4,000-ft. class).
Motors (No., hp.): one at 300 hp.
Pumps: One 7¼ by 14-in.
Fuel: Natural gas or diesel.
Water supply: Wells.
Nearest supply center: Big Spring, Tex.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	150	200
Oil string	7	3,100	300

Geological Data

Formation tops—	Depth (ft.)
Top San Andres	3,100

Remarks: Operators set pipe on top of pay and complete in 6⅛-in. open hole, drilling 100 ft. into pay zone. Open hole is treated with 1,000 gal. of acid, followed by 4,000 gal. of gelled acid with 3 lb. of sand per gal. Hole is then flushed with 200 bbl. of crude oil prior to completion. Centralizers are used on the pay string.

DRILLING REPORT

PRENTICE FIELD
Terry and Yoakum Counties, Texas

Pay zone: Glorietta at 6,000 ft.; Clearfork at 6,500 ft.
TD (avg.) ..... 6,000-6,500 ft.

Equipment

Derrick: 127-ft. cantilever mast.
Draw works: Whirlwind S-60.
Motors (No., hp.): One at 210 hp.; one at 375 hp.
Pumps: One 7¼ by 15-in.
Fuel: Diesel or natural gas.
Water supply: Wells.
Terrain and roads: Flat; dirt roads.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	13⅜	100	100
Intermediate	8⅝-9⅝	2,500	1,000
Oil string	5½-7	6,000-6,500	2,400

Geological Data

Formation tops—	Depth (ft.)
Glorietta	6,000
Clearfork	6,500

Remarks: Lost circulation may occur at 4,200 ft. in the San Andres. Glorietta pay zone comes in at 6,000 ft. and is 20 to 35 ft. thick. Operators drill through pay, set pipe and acidize through perforations with 1,000-10,000 gal. Clearfork pay at 6,500 ft. is 185 ft. thick and is acidized in sections, using straddle packers. Total acid treatment in this zone may be as high as 20,000 gal. Some operators dually complete their wells rather than drill twin wells.

DRILLING REPORT

SPRABERRY FIELD
Midland, Glasscock, Upton, and Reagan Counties, Texas

Pay zone	Spraberry
TD (avg.)	7,635 ft.

Equipment

Derrick: 133-ft. cantilever.
Draw works: National 75-CA.
Motors (No., hp.): Two at 460 hp.
Pumps: One 7¾ by 18-in. and one 7¼ by 15-in.
Fuel: Natural gas.
Water supply: Wells.
Nearest supply center: Odessa.
Terrain and roads: Rolling ranch country; dirt roads passable.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	8⅝ or 10¾	355	300
Intermediate	7⅝	3,500	7,300
Oil string	5½	7,360	300 (8 per cent)

Typical Mud Properties

Interval (ft.)	3,300-6,300	6,300-7,360	7,360-TD
Type mud	Oil emulsion	Oil emulsion	Oil
Weight (lb./gal.)	9.4	9.0	
Filter cake (in.)	2/32	2/32	
Viscosity (sec.)	35	40	
Water loss (cc.)	12	12	

Mud Summary

Material—	Amount
Salt gel, sacks	425
Santamerse, sacks	10
Cottonseed hulls, sacks	100
Fibertex, sacks	140
Oil, bbl.	1,000

Geological Data

Formation tops—	Depth (ft.)
Tops vary along trend with pay	6,500-8,100
Anhydrite	1,520
Yates	2,360
Grayburg	3,820
Spraberry	7,060
Dean	8,430
Strawn	10,185
Devonian	11,170
Silurian	11,570
Fusselman	11,705
Ellenburger	11,960

Remarks: Occasionally minor lost circulation may occur in drilling the Spraberry zones. In many cases, operators set 5½-in. liners from 3,500 ft. to total depth. Some mud programs call for saturated salt water to the intermediate string; below this casing point, mud with 3 to 5 per cent saturation is used. In the past, operators set pipe on top of the basal Spraberry and completed this zone barefoot, using 20,000 to 30,000 gal. of sand-oil with 1½ lb. of sand per gal. Where the upper Spraberry is producing, it is given a similar treatment. In recent wells, however, operators set pipe through the lower zone, perforate, and fracture using large volumes of sand-oil and high pressures. In open-hole completions, the basal Spraberry is given jet shots to stimulate production.

DRILLING REPORT

FORT CHADBOURNE FIELD
Coke and Runnels Counties, Texas

Pay zone	Strawn
TD (avg.)	5,630 ft.

Normal Rig-Time Distribution

Total days (spud to rig release)	20-25

Bit Data

Total number of bits	30
Feet per bit	Variable: 91-334
Hours per bit	14

Equipment

Derrick: 127-ft. L. C. M. mast.
Draw works: Wilson Giant.
Motors (No., hp.): Two at 240 hp.
Pumps: One 7¼ by 14-in. plus one auxiliary.
Fuel: Natural gas or butane.
Water supply: Wells.
Nearest supply center: Abilene, Tex.
Terrain and roads: Rolling; passable.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	9⅝	630	600
Oil string	5½	5,344	500

Typical Mud Properties

Interval (ft.)	0-4,500	4,500-5,000	5,000-5,500
Type mud	Low pH red mud	Low pH red mud	Low pH red mud
Weight (lb./gal.)	9.7	9.6	9.6
Filter cake (in.)	2/32	2/32	2/32
Viscosity (sec.)	38	40	40
Water loss (cc.)	15	12	12
pH	8.5	8.5	9.0
Salt content (p.p.m.)	4,000	3,000	2,500

Mud Summary

Material—	Amount
Magcogel, sacks	562
Caustic, lb.	1,415
Quebracho, lb.	1,585
Tan-a-thin, lb.	1,470
Soda ash, lb.	6,350
Lime, lb.	600
Lost-circulation material, sacks	117

Geological Data

Formation tops—	Depth (ft.)
Valera	1,810
Base Coleman Junction	2,300
Dothan	2,520
Noodle Creek	2,600
Flippen	2,930
Canyon Reef	3,250
Palo Pinto	4,370
Upper Capps	4,530
Strawn sand	5,130

Remarks: Some wells have lost circulation at 4,100 to 4,200 ft. Centralizers are used above and below the pay. Casing is usually set on bottom and perforated with either jets or bullets.

DRILLING REPORT

HULLDALE FIELD
Schleicher County, Texas

Pay zone	Strawn reef (Pennsylvanian)
TD (avg.)	5,800-6,100 ft.

Cost Data

Footage price	$6.90
Day-work rate with drill pipe	725.00

Normal Rig-Time Distribution

Days on footage rate	37
Days on day-work rate	5
Total days (spud to rig release)	42

Bit Data

Total number of bits	35
Feet per bit	145

Equipment

Derrick: 127-ft. L. C. Moore mast.
Draw works: Wilson Giant with air clutch.
Motors (No., hp.): Two PCG-1879, two 240-hp. Budas.
Pumps: 7¼ by 14-in. Emsco plus one auxiliary.
Fuel: Gas.
Water supply: Wells.
Nearest supply center: San Angelo.
Terrain and roads: Rolling ranch country; dirt roads passable.

Casing Program

	O.d. (in.)	Casing seat (ft.)
Surface	10¾	600
Oil string	5½	TD

Geological Data

Formation tops—	Depth (ft.)
Palo Pinto	5,080
Reef	5,540
Strawn	5,560
Top porosity	5,670
Strawn reef	5,800
Ellenburger	6,660

Remarks: Lost circulation may occur above 500 ft.

East Texas

CARTHAGE FIELD
Panola County, Texas

Pay zone	Pettit
TD (avg.)	6,000-6,500 ft.

Cost Data

Footage price	$4.50-$5.00
Day-work rate with drill pipe	600-700
Day-work rate without drill pipe	500-600

Normal Rig-Time Distribution

Days on footage rate	28
Days on day-work rate	5
Total days (spud to rig release)	33

Bit Data

Total number of bits	23
Feet per bit	271
Hours per bit	20

Equipment

Derrick: 133-ft. cantilever.
Draw works: N-7 Brewster.
Motors (No., hp.): Two at 250 hp.

Pumps: One 7¾ by 16-in.
Fuel: Diesel or butane.
Water supply: Creeks, ponds, wells.
Nearest supply center: Shreveport, Longview, Kilgore.
Terrain and roads: Rolling; some river bottom. Board roads needed in winter in river bottoms.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	9⅝	700	200
Oil string	5½	TD	250

Typical Mud Properties

Interval (ft.)	0-4,500	4,500-TD
Type mud	Native	Alkaline, Tannate, Driscose
Weight (lb./gal.)	9.0-10	10-11
Filter cake (in.)	4/32	3/32
Viscosity (sec.)	38-40	40-45
Water loss (cc.)		12-15
pH		11

Geological Data

Formation tops—	Depth (ft.)
Pecan Gap	1,800
Base Austin chalk	2,680
Paluxy	2,900
James	5,500
Pettit	6,100
Travis Peak	6,370

Remarks: Average mud bills run $1,500 to $2,000. The massive anhydrite section is drilled using alkaline, tannate, and Driscose.

DRILLING REPORT

NECHES FIELD
Anderson County, Texas

Pay zone	Sub-Clarksville and Woodbine
TD (avg.)	4,600-4,800 ft.

Cost Data

Footage price	$2.15
Day-work rate with drill pipe	550.00
Day-work rate without drill pipe	500.00

Normal Rig-Time Distribution

Days on footage rate	10
Days on day-work rate	3
Total days (spud to rig release)	13

Bit Data

Total number of bits	8
Feet per bit	701
Hours per bit	13

Equipment

Derrick: 127-ft. with 10-ft. substructure.
Draw works: Bethlehem Twister (7,000-ft. capacity) with 4½-in. drill pipe.
Motors (No., hp.): Three QM 671 diesels.
Pumps: 7½ by 14-in. with two G.M. 671 diesels.
Fuel: Diesel.
Water supply: Well.
Nearest supply center: Tyler.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	8⅝	500	195
Oil string	5½	4,750	*100-†300

Typical Mud Properties

Interval (ft.)	0-500	500-4,500	4,500-TD
Type mud	Native	Sand	Gel
Weight (lb./gal.)	8.3-9.0	9.0-10.0	10.0
Filter cake (in.)		2/32	2/32
Water loss (cc.)		9.0	9.0

Mud Summary

Material—	Amount
Bentonite, sacks	40
Caustic, lb.	300
Quebracho, lb.	200
Driscose, lb.	100

Geological Data

Formation tops—	Depth (ft.)
Pecan Gap	3,370
Austin chalk	4,400
Sub-Clarksville	4,550
Woodbine	4,690

*First stage. †Second stage with D.V. tool at 2,000 ft.

Remarks: Some operators cement the oil string in two stages using a D.V. tool as outlined above. Ideal conditions exist at Neches for fast drilling; permanent-type completions are being used.

DRILLING REPORT

WOODLAWN FIELD
Harrison County, Texas

Pay zone	Pettit
TD (avg.)	6,300-7,000 ft.

Cost Data

Footage price	$4.70-$.500
Day-work rate with drill pipe	675.00

Normal Rig-Time Distribution

Days on footage rate	30
Days on day-work rate	3
Total days (spud to rig release)	33

Bit Data

Total number of bits	22
Feet per bit	300

Equipment

Derrick: 133-ft. cantilever.
Draw works: N-7 Brewster.
Motors (No., hp.): Two at 250 hp.
Pumps: One 7¾ by 16-in.
Fuel: Diesel or butane.
Water supply: Creeks, ponds, wells.
Nearest supply center: Longview, Tex.
Terrain and roads: Rolling; board roads necessary in river bottoms.

Casing Program

	O.d. (in.)	Casing seat(ft.)	Cement (sacks)
Surface	9⅝	1,860	800
Oil string	5½	6,800	300

Typical Mud Properties

Interval (ft.)	0-4,500	4,500-TD
Type mud	Native	Alkaline, Tannate, Driscose
Weight (lb./gal.)	9.5-10	10-11
Filter cake (in.)	4/32	3/32
Viscosity (sec.)	38-40	40-45
Water loss (cc.)		12-15
pH		11

Geological Data

Formation tops—	Depth (ft.)
Nacatoch	1,360
Blossom	2,400
Austin chalk	2,620
Lower Cretaceous	2,800
Paluxy	3,460
Massive anhydrite	5,240
Rodessa	5,500
Pine Island shale	6,150
Pettit	6,300
Travis Peak	6,600

Remarks: Most operators get pipe on bottom, perforate, acidize, and complete. Mud must be converted to a gypsum base to drill through the anhydrite. Average mud bills run about $1,500 to $2,000.

DRILLING REPORT

BIG MINERAL FIELD
Grayson County, Texas

Pay zone: Pennsylvanian sandstones at 3,600, 5,000, 5,500, 6,200, and 7,000 ft.
TD (avg.) 6,000 ft.

Normal Rig-Time Distribution

Days on footage rate	14
Days on day-work rate	1
Total days (spud to rig release)	15

Equipment

Derrick: 126-ft. cantilever.
Draw works: M-750.
Motors (No., hp.): Three at 250 hp.
Pumps: One D-300 and one D-500.
Fuel: Natural gas.
Water supply: Lake Texoma.
Nearest supply center: Whitesboro.
Terrain and roads: Flat; good roads.

Casing Program

	O.d. (in.)	Casing seat(ft.)	Cement (sacks)
Surface	10¾	400	200
Oil string	5½	6,000	1,400

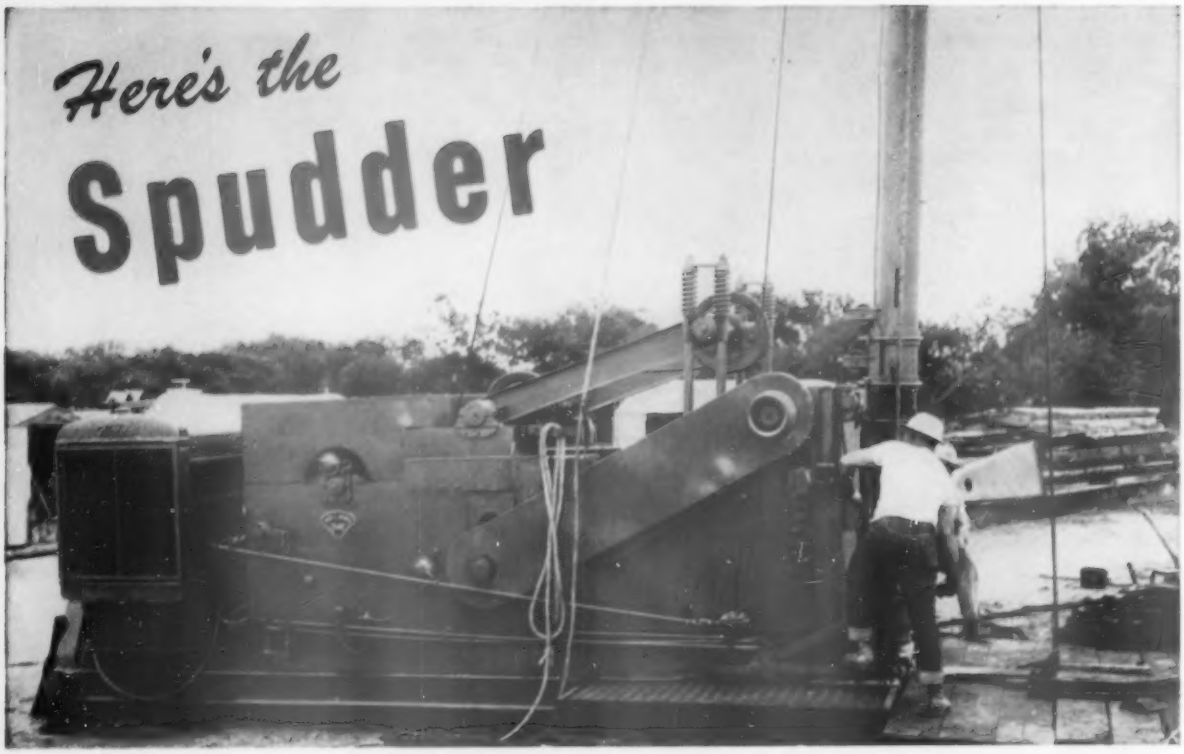
Typical Mud Properties

Interval (ft.)	0-3,300	3,300-TD
Type mud	Native	Oil emulsion
Weight (lb./gal.)	9.8	9.8-10.1
Filter cake (in.)	3/32	2/32
Viscosity (sec.)	34	40-45
Water loss (cc.)	30-30	6-8
pH	7	10.5
Salt content (p.p.m.)	3,000	3,000

Geological Data

Formation tops—	Depth (ft.)
Middle Strawn	3,400
Pay sand (Strawn)	3,600
Pay sand (Strawn)	5,000
Pay sand (Strawn)	5,500
Pay sand (Strawn)	6,200
Pay sand (Strawn)	7,000
Woodford	7,430
Munton	7,580
Viola	7,585
Bromide	8,520
McLish	9,000
Oil Creek	10,250

Remarks: Contractors have some difficulty in keeping holes straight. Rotary rigs are released after running oil string. Completions require about 7 days, using reverse circulation. Oil string is cemented in two stages; service companies set tool at 1,550 ft. and circulate cement to surface in first stage.



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DRILLING REPORT

South Texas and Gulf Coast

CONROE TOWNSITE FIELD
Montgomery County, Texas

Pay zone ..... Yegua-Cockfield
TD (avg.) ..... 5,230 ft.

Normal Rig-Time Distribution

Total days (spud to rig release) 16

Equipment

Derrick: 126-ft. cantilever mast.
Draw works: H-525.
Motors (No., hp.): Three at 200 hp.
Pumps: One 7¼ by 15-in. (C-250).
Fuel: Natural gas or butane.
Water supply: Wells.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	16	60	60
Intermediate	10¾	2,050	800
Oil string	5½	5,230	650

Geological Data

	Depth (ft.)
Formation tops—	
Top pay	5,200

Remarks: Operators use both centralizers and scratchers on the oil string. The addition of gel to the cement is a common practice and the gel averages 8 per cent.

DRILLING REPORT

KUHLMAN-BENDER FIELD
Harris-Montgomery Counties, Texas

Pay zone ..... Cockfield sand
TD (avg.) ..... 6,000 ft.

Cost Data

Footage price $2.75
Day-work rate with drill pipe 650.00
Day-work rate without drill pipe 600.00

Normal Rig-Time Distribution

Days on footage rate 11
Days on day-work rate 7
Total days (spud to rig release) 18

Equipment

Derrick: 126-ft. cantilever mast.
Draw works: Whirlwind S-60.
Motors (No., hp.): Two at 300 hp.
Pumps: One 7¼ by 15-in. C-250.
Fuel: Butane.
Water supply: Creek.
Nearest supply center: Conroe, Tex.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	9⅝	2,027	1,100
Oil string	5½	5,858	115

Geological Data

	Depth (ft.)
Formation tops—	
Top pay sand	5,800

Remarks: This area is under the jurisdiction of the state board of water engineers who offer the option of setting an amount of protective casing sufficient to cover water-bearing sands down to 2,000 ft. or to cement the oil string with multiple-stage cementing devices to provide the same protection to 2,000 ft. About 75 per cent of the operators in these areas follow the latter procedure.

DRILLING REPORT

MARY ELLEN O'CONNOR FIELD
Refugio County, Texas

TD (avg.) ..... 6,000-6,100 ft.

Normal Rig-Time Distribution

Total days (spud to rig release) 10

Equipment

Derrick: 126-ft. cantilever mast.
Draw works: H-525.
Motors (No., hp.): Two at 300 hp. or three at 200 hp.
Pumps: One 7¼ by 15-in. plus one 7¼ by 14-in. standby.
Fuel: Natural gas or diesel.
Water supply: Wells.
Terrain and roads: Flat terrain.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	9⅝	1,350	400
Oil string	5½	6,050	350

Geological Data

	Depth (ft.)
Formation tops—	
Top oil sand	6,000

Remarks: Many wells are dually completed where practicable and permanent-type well-completion equipment is installed.

DRILLING REPORT

REDFISH BAY FIELD
Nueces or Calhoun Counties Texas; Corpus Christi Bay

Pay zone ..... Oligocene and Frio
TD (avg.) ..... 8,400 ft.

Equipment

Derrick: 127-ft. cantilever.
Draw works: Super 7-11.
Motors (No., hp.): Three at 400 hp.
Pumps: One 7¾ by 18-in. and one 7¼ by 15-in.
Fuel: Natural gas.
Water supply: Barge operations.
Nearest supply center: Corpus Christi.
Terrain and roads: Corpus Christi Bay.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Conductor	22	50	Pulled down
Surface	16	158	250
Intermediate	10¾	1,500	1,000
Oil string	7⅝	8,400	1,000

Mud Summary

Material—	Amount
Gel, sacks	49
Baroid, sacks	1,070
Sapp, lb.	4,000
Quebracho, lb.	3,625
Lime, sacks	2

Geological Data

	Depth (ft.)
Formation tops—	
Top pay sand	8,300

SEELIGSON FIELD
Jim Wells County, Texas

Pay zone ..... Frio-Vicksburg
TD (avg.) ..... 7,150 ft.

Equipment

Derrick: 127-ft. cantilever mast.
Draw works: National 75.
Motors (No., hp.): Three at 210 hp. plus one at 210 hp. on standby pump.
Pumps: One 7¼ by 15-in. and one 7¼ by 14-in.
Fuel: Natural gas or butane.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	9⅝	2,020	900
Oil string	5½	7,071	600

Mud Summary

Material—	Amount
Baroid, sacks	2,404
Aquagel, sacks	685
Hydrotan, lb.	1,959
Oilfos, sacks	60
Driscose, lb.	350
Tannex, lb.	600

Remarks: Seeligson is a multipay field, producing from sands in the Frio-Vicksburg section. As a consequence, total depths on wells are variable.

DRILLING REPORT

Louisiana

COTTON VALLEY TREND
North Louisiana

Pay zone ..... Cotton Valley sands
TD (avg.) ..... 8,000-10,000 ft.

Cost Data

Footage price $7.40
Day-work rate with drill pipe 850.00
Day-work rate without drill pipe 700.00

Normal Rig-Time Distribution

Days on footage rate 44
Days on day-work rate 24
Total days (spud to rig release) 68

Equipment

Derrick: 136-ft. steel derrick or 127-ft. cantilever mast.
Draw works: M-10,000.
Motors (No., hp.): Two at 400 hp.
Pumps: One 7¾ by 16-in. plus one C-250 auxiliary.
Fuel: Gas or butane.
Water supply: Bayous or wells.
Nearest supply center: Shreveport or Monroe.
Terrain and roads: Low, fairly level country; roads very muddy during rainly season.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	1,560	....
Oil string	5½	TD	850

Geological Data

Formation tops— (Tops vary along trend)	Depth (ft.)
Nacatoch	1,070
Saratosa	1,460
Base Annona	1,810
Lower Cretaceous	2,670
Massive anhydrite	4,260
Pettit	5,400
Travis Peak	5,700
Cotton Valley	7,700
Cotton Valley black shale	7,800
"C" sand	8,120
"D" sand	8,170
Bodcaw	8,300

DRILLING REPORT

CADDO-PINE ISLAND FIELD
Caddo Parish, Louisiana

Pay zone	Annona chalk
TD (avg.)	1,575 ft.

Cost Data

Footage price	$1.50-$2.00

Normal Rig-Time Distribution

Total days (spud to rig release)	3

Bit Data

Total number of bits	2
Feet per bit	800

Equipment

Derrick: Small rotary rigs or cable tools.
Water supply: Ponds and bayous.
Nearest supply center: Shreveport, La.

Terrain and roads: Flat; rains make roads very muddy.

Casing Program

	O.d. (in.)	Casing seat (ft.)
Surface	8⅝	60-100
Oil string	5½	1,575

Geological Data

Formation tops—	Depth (ft.)
Annona chalk	1,500

DRILLING REPORT

EAST LAKE PALOURDE FIELD
Assumption Parish, Louisiana

Pay zone	Miocene sands
TD (avg.)	13,500 ft.

Normal Rig-Time Distribution

Days on footage rate	47
Days on day-work rate	4
Total days (spud to rig release)	51

Bit Data

Total number of bits	44

Equipment

Derrick: 136-ft. standard.
Draw works: National 125.
Motors (No., hp.): Three at 500 hp.
Pumps: Two 7¾ by 18-in.
Fuel: Diesel or gas.
Water supply: Bayou.
Nearest supply center: Houma.

Casing Program

Formation tops—	O.d. (in.)	Casing seat (ft.)	Depth (ft.)
Conductor	16	140	
Surface	10¾	2,300	
Oil string	5½	13,500	

Geological Data

Formation tops—	Depth (ft.)
Top Miocene oil sand	13,380

DRILLING REPORT

NORTHWEST BRANCH FIELD
Acadia Parish, Louisiana

Pay zone	Frio
TD (avg.)	12,600 ft.

Normal Rig-Time Distribution

Days on footage rate	30
Days on day-work rate	30
Total days (spud to rig release)	60

Bit Data

Total number of bits	37
Feet per bit	340

Equipment

Derrick: 133-ft. standard.
Draw works: Big Giant.
Motors (No., hp.): Steam rig (four boilers).
Pumps: One 18-in.; one 20-in., and one 22-in.
Fuel: Field gas.
Water supply: Field well.

Yes, dehydration of vapor and liquid feed stocks in petrochemical processing is best accomplished with superior drying efficiency by use of FLORITE DESICCANT.

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Nearest supply center: Eunice, La.
Terrain and roads: Board roads.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	16	80	150
Intermediate	10¾	1,818	1,000
Oil string	7	10,686	8,000
Liner	5	10,565 to 11,697	525

Typical Mud Properties

Interval (ft.)	6,000-9,000	9,000-10,800	10,800-TD
Type mud	Water or lime base	Oil emul.	Oil emul.
Weight (lb./gal.)	9.7-10.2	10.7-13.0	14.8-15.0
Filter cake (in.)	2/32	2/32	2/32
Viscosity (sec.)	35-50	50-60	50-60
Water loss (cc.)	8-20	5-6	4-5
pH	12	12	12

Mud Summary

Material—	Amount
Baroid, sacks	11,964
Aquagel, sacks	546
Lime, lb.	41,900
Caustic soda, lb.	16,400
Quebracho, lb.	5,675
Tannex, lb.	8,575
Impermix, lb.	5,650
Driscose, lb.	2,680
Carbonox, lb.	3,650
Lignox, lb.	1,350
Micatex, lb.	15,975
Fibertex, lb.	3,240
Strataseal	4
Jel Flakes, lb.	3,250
Kembrake, lb.	50

Geological Data

Formation tops—	Depth (ft.)
Top oil sand	12,500

DRILLING REPORT

Oklahoma

CADDO FIELD
Carter County, Oklahoma

Pay zone: Springer sands, Sycamore, Woodford, Hunton, and Viola.
TD (avg.): 3,800-5,100 ft. to Hunton limestone.

Cost Data

Footage price: (All day work as a general rule)

Normal Rig-Time Distribution

Total days (spud to rig release) 45-60

Bit Data

Total number of bits	27-40
Feet per bit	Variable
Hours per bit	Variable

Equipment

Derrick: 126-ft. jackknife mast.
Draw works: U-10, U-34, National 50, H-35, or Emsco 50.
Motors (No., hp.): Two NKR Waukeshas.
Pumps: One National C-250 or Emsco D-300 or D-175.
Fuel: Natural gas.
Water supply: Ponds, water wells.
Nearest supply center: Ardmore, Okla.
Terrain and roads: Secondary roads.

Casing Program

	O.d. (in.)	Casing seat (ft.)
Surface	10¾	300
Oil string	7	4,500

Geological Data

Formation tops—	Depth (ft.)
Goddard sand	2,980
Caney	3,330
Sycamore	3,750
Woodford	4,010
Hunton	4,350
Sylvan	4,440

(Note: Tops vary as structure is sharp and there appears to be some faulting.)

Remarks: Crooked holes due to steep dips and lost circulation in the Woodford and Hunton are the main drilling problems. Operators set pipe through pay zones and perforate; dual completions are common. Drilling time on wells and bits required varies considerably from well to well, depending upon structural position.

DRILLING REPORT

GOLDEN TREND FIELD
Garvin County, Oklahoma

Pay zone ..... Springer sands
TD (avg.) ..... 9,500 ft.

Cost Data

Footage price	$6.00-$7.00
Day-work rate with drill pipe	800.00-750.00
Day-work rate without drill pipe	700.00-750.00

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Normal Rig-Time Distribution

Days on footage rate	37
Days on day-work rate	3
Total days (spud to rig release)	40

Bit Data

Total number of bits	64
Feet per bit	150

Equipment

Derrick: 127-ft. cantilever mast.
Draw works: GB-500.
Motors (No., hp.): Two at 350 hp. or three at 225 hp.
Pumps: Two 7¼ by 15-in.
Fuel: Gas.
Water supply: Ponds.
Nearest supply center: Lindsay, Okla.
Terrain and roads: Hilly, pavement, and county roads.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	600	400
Oil string	7	9,500	500

Typical Mud Properties

Interval (ft.)	0-5,000	5,000-8,000	8,500-9,500
Type mud	Native	Caustic	Quebracho emul.
Weight (lb./gal.)		9.3	9.4
Viscosity (sec.)		75	90
Water loss (cc.)		7	3
pH		10.5	10.5
Salt content (p.p.m.)		5-7,000	5-7,000

Mud Summary

Material—	Amount
Gel, sacks	850-900
Quebracho, lb.	500
Caustic, lb.	6,000
Carbonex, lb.	20,000
Oil, bbl.	350

Geological Data

Formation tops—	Depth (ft.)
Checkerboard	7,620
Deese	7,690
First Deese sand	7,760
Hart sand	8,600
Springer	9,260
Springer sand	9,510

Remarks: Contractors use approximately 15 per cent oil content after mudding up. Lost circulation may occur in Springer sections from 9,000-9,500 ft.

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DRILLING REPORT

SOUTHWEST MAYSVILLE FIELD
Garvin County, Oklahoma

Pay zone	Simpson
TD (avg.)	6,700 ft.

Cost Data

Footage price	$5.50
Day-work rate with drill pipe	785.00
Day-work rate without drill pipe	735.00

Normal Rig-Time Distribution

Days on footage rate	32
Days on day-work rate	18
Total days (spud to rig release)	50

Equipment

Derrick: 127-ft. Emsco mast.
Draw works: GB-500.
Motors (No., hp.): Two 280 hp.
Pumps: Two 7¼-in. by 15-in.
Fuel: Gas.
Water supply: Pond.
Nearest supply center: Lindsay.
Terrain and roads: Pavement and dirt section-line roads.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	515	200
Oil string	7	6,700	500

Typical Mud Properties

Interval (ft.)	5,000-6,500	6,500-TD
Type mud	Caustic	Quebracho emulsion
Weight (lb./gal.)	9.5	9.5
Viscosity (sec.)	75	90
Water loss (cc.)	7	3
pH	10½	10½
Salt content (p.p.m.)	5,000-7,000	5,000-7,000

Mud Summary

Material—	Amount
Gel, sacks	600
Caustic, lb.	3,500
Quebracho, lb.	2,500
Carbonox, lb.	15,000
Oil, bbl.	350

Geological Data

Formation tops—	Depth (ft.)
Base Abernathy	5,630
Viola	5,920
Bromide Dense	6,190
First Bromide	6,360
Second Bromide	6,550

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DRILLING REPORT

BRADLEY AREA
McClain County, Oklahoma

Pay zone ..... Springer and Simpson sands
TD (avg.) ..... 12,250 ft.

Cost Data

Footage price	$10.90
Day-work rate with drill pipe	1,000
Day-work rate without drill pipe	850

Bit Data

Total number of bits	105
Feet per bit	115

Equipment

Derrick: 136-ft. L. C. Moore steel derrick.
Draw works: Wilson-Titan.
Motors (No., hp.): Two 420-hp. Climax engines.
Pumps: One 7¼ by 14-in. G-D and one 7¼ by 12-in. Clark Triplex.
Fuel: Gas or butane.
Water supply: Ponds.
Nearest supply center: Lindsay.
Terrain and roads: Section-line roads.

	O.d. (in.)	Casing seat (ft.)
Surface	10¾	600
Oil string	5½	TD

Geological Data

Formation tops— (Tops variable)	Depth (ft.)
Oread	5,750
Layton	6,580
Hogshooter	7,110
Deese	7,730
Upper Gibson sand	8,380
Lower Gibson sand	8,580
Upper Hart	8,670
Lower Hart	8,830
Caney	9,150
Woodford	9,370
Hunton	9,530
Sylvan	9,850
Viola	10,050
Bromide	10,400
Tulip Creek	10,750

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DRILLING REPORT

LITTLE CHIEF FIELD
Osage County, Oklahoma

Pay zone ..... Burbank sand
TD (avg.) ..... 2,890 ft.

Cost Data

Footage price	$3.18
Day-work rate with drill pipe	514.00
Day-work rate without drill pipe	482.00

Normal Rig-Time Distribution

Days on footage rate	9.5
Days on day-work rate	1.0
Total days (spud to rig release)	10.5

Bit Data

Total number of bits	8
Feet per bit	360

Equipment

Derrick: 97-ft. cantilever mast.
Draw works: U-34.
Motors (No., hp.): One at 200 hp.
Pumps: One 7¼ by 12-in. powered by two 200-hp. engines.
Fuel: Natural gas or butane.
Water supply: Ponds.
Nearest supply center: Shidler.
Terrain and roads: Rolling; good roads.

Casing Program

	O.d. (in.)	Cacing seat (ft.)
Surface	10¾	120
Oil string	7	2,890

Mud Summary

Average mud bills run about $300-$325.

Geological Data

Formation tops—	Depth (ft.)
Big lime	2,550
Oswego	2,670
Pink lime	2,850
Burbank sand	2,880

Remarks: Few drilling problems exist at Little Chief. Completions are made with service units, either "barefoot" or through perforations. Light rotary rigs and cable tools are used in Osage County.

DRILLING REPORT

OCONEE AND CENTRAHOMA FIELD
Coal County, Oklahoma

Pay zone ..... Simpson sands
TD (avg.) ..... 7,000-7,500 ft.

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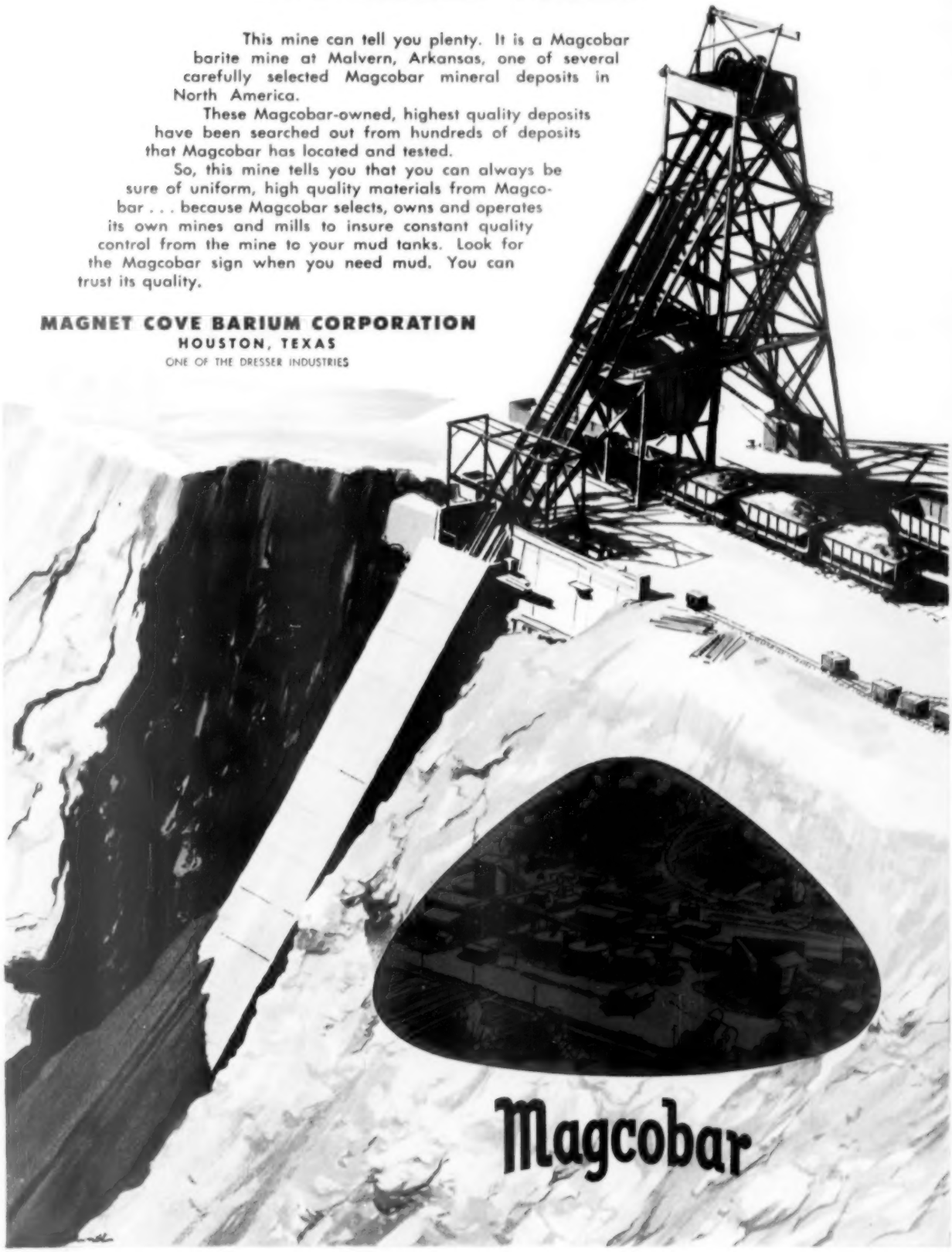

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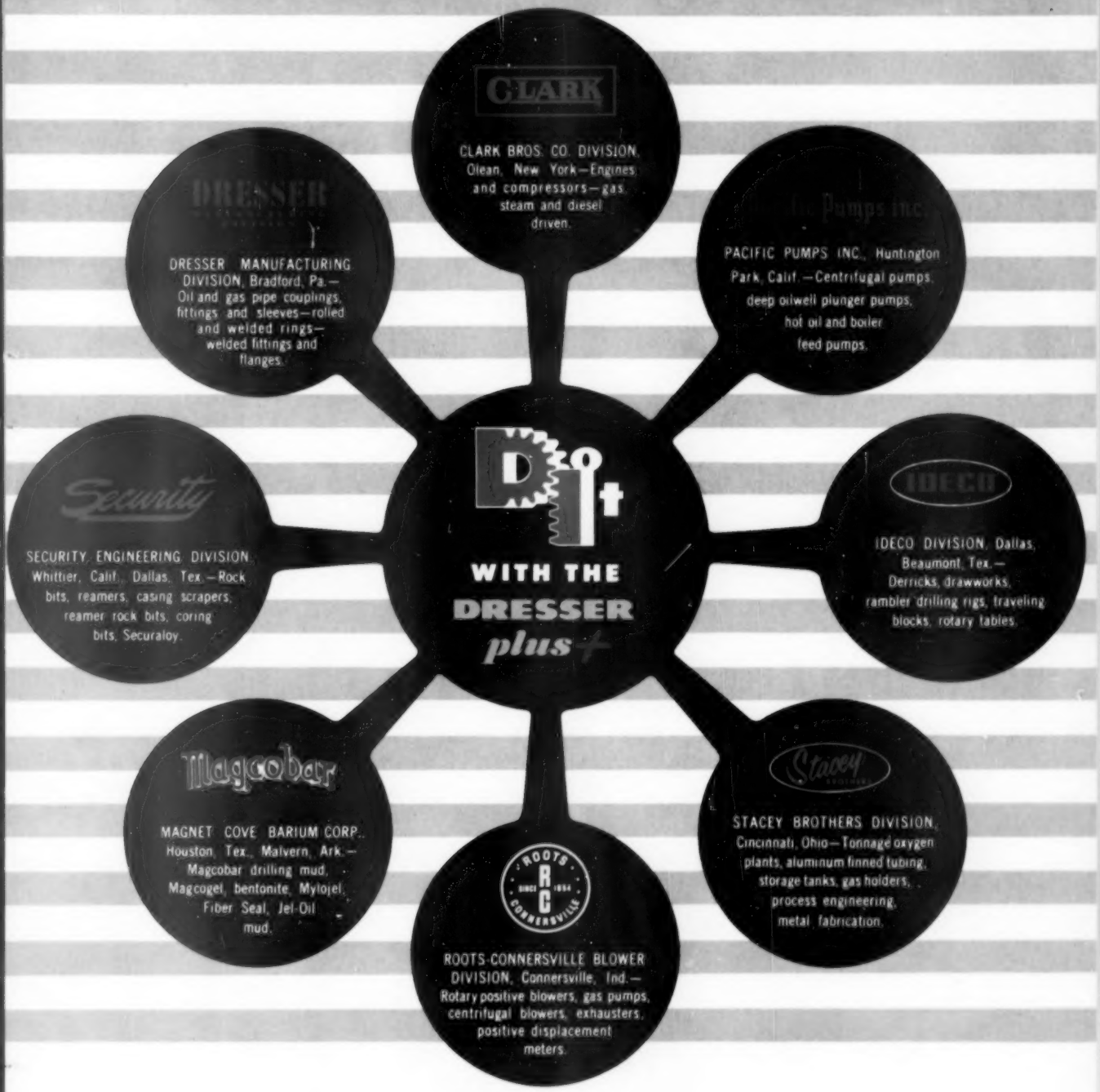
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Cost Data

Footage price	$8.25
Day-work rate with drill pipe	725.00
Day-work rate without drill pipe	600.00

Normal Rig-Time Distribution

Days on footage rate	43
Days on day-work rate	15
Total days (spud to rig release)	58

Bit Data

Total number of bits	56
Feet per bit	125

Equipment

Derrick: 126-ft. cantilever mast.
Draw works: National 50.
Motors (No., hp.): Two at 400 hp.
Pumps: One 15½ by 17½-in.
Fuel: Natural gas.
Water supply: Pond.
Nearest supply center: Ada.
Terrain and roads: Rolling; paved; roads near field.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	330	300
Oil string	5½	6,900	300

Typical Mud Properties

Interval (ft.)	350-1,000	1,000-4,000	4,000-TD
Type mud	Water	Gel	Gel
Weight (lb./gal.)		9.5-10	9.5-10.5
Filter cake (in.)		3/32	2/32
Viscosity (sec.)		40-100	100-300
Water loss (cc.)		5	3

Mud Summary

Material—	Amount (lb.)
Weight material	100,000
Gel	100,000
Caustic soda	3,500
Carbonox	10,000
Lost-circulation material	3,000
Tannex	1,000
Soda ash	1,000

Geological Data

Formation tops—	Depth (ft.)
Wapanucka	4,080
Cromwell	4,610
Penn. Caney	4,800
Woodford	5,420
Hunton	5,600
Sylvan	5,800
Viola	5,900
Bromide	6,150
McLish	6,320
Basal McLish sand	6,640
Basal Oil Creek sand	6,920

Remarks: Hole deviation occasionally is a problem, otherwise relatively easy digging in upper beds. Hunton and Viola limestones slow drilling operations.

DRILLING REPORT

SOUTH FREDERICK AREA
Tillman County, Oklahoma

Pay zone	Pennsylvanian sands
TD (avg.)	5,100-5,600 ft.

Cost Data

Footage price (to 5,100 ft.)	$3.50
Day-work rate with drill pipe	700.00
Day-work rate without drill pipe	650.00

Normal Rig-Time Distribution

Days on footage rate	15
Days on day-work rate	5
Total days (spud to rig release)	20

Bit Data

Total number of bits	55-59
Feet per bit	93

Equipment

Derrick: 127-ft. L. C. M. cantilever mast.
Draw works: National 50.
Motors (No., hp.): Two Le Roi H-2,000 or two Waukeshas.
Pumps: One C-250 National.
Fuel: Natural gas or butane.
Water supply: Pond.
Terrain and roads: Passable.

Mud Summary

Estimated mud bill, $3,000.00.

Geological Data

Formation tops—	Depth (ft.)
Canyon	3,310
Strawn	4,050

DRILLING REPORT

SIMPSON PRODUCTION
Cleveland County, Oklahoma

Pay zone	Simpson sands
TD (avg.)	8,080 ft.

Cost Data

Footage price	$6.75
Day-work rate with drill pipe	750.00

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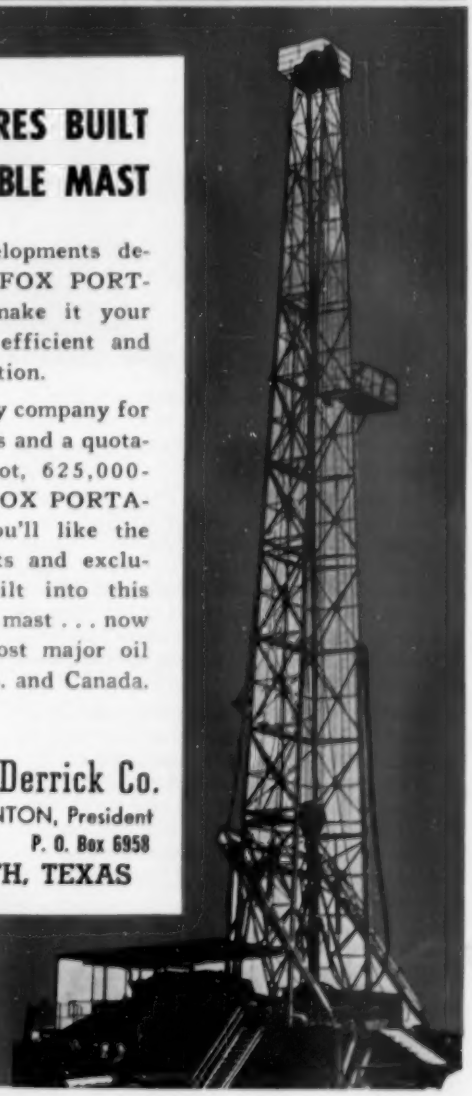

Normal Rig-Time Distribution

Days on footage rate	41
Days on day-work rate	9
Total days (spud to rig release)	50

Bit Data

Total number of bits	55
Feet per bit	145

Equipment

Derrick: P-17 127-ft. Emsco mast.
Draw works: Emsco GB-500.
Motors (No., hp.): Two 280-hp. V.U. Climax engines.
Pumps: One 7¼ by 14-in. Gardner-Denver plus one auxiliary.
Fuel: Gas-butane.
Water supply: Ponds.
Nearest supply center: Oklahoma City.
Terrain and roads: Section-line roads.

Geological Data

Formation tops— (Tops variable)	Depth (ft.)
Oswego	6,580
Pink lime	6,830
Unconformity zone	6,860
Base Penn.-top Hunton	6,880
Sylvan	6,920
Viola	7,010
Simpson	7,140
First Wilcox	7,260
Second Wilcox	7,410
McLish	7,640

DRILLING REPORT

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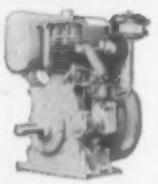
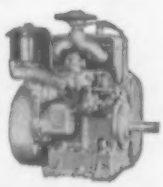
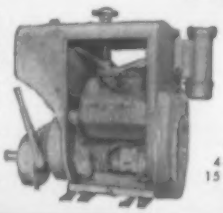


4-cycle single cylinder 3 to 9 hp.



2-cylinder models 7 to 15 hp.



V-type 4-cylinder 15 to 36 hp.

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Hugoton Embayment

GUYMON-HUGOTON FIELD
Texas-Oklahoma Panhandles, Southwestern Kansas

Pay zone ..... Permian limestones
TD (avg.) ..... 2,500-3,000 ft.

Equipment

Derrick: 98-ft. cantilever mast.
Draw works: S-50.
Motors (No., hp.): One at 200 hp. and one at 350 hp.
Pumps: One 7¼ by 14-in. P-HD.
Fuel: Natural gas.
Water supply: Wells.
Nearest supply center: Liberal, Kans.
Terrain and roads: Fairly flat wheat country; dirt roads passable.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	8⅝	450	200
Oil string	5½	2,600	750

Typical Mud Properties

Interval	0-TD
Type mud	Bentonite
Weight (lb./gal.)	9.6
Filter cake (in.)	1/32
Viscosity (sec.)	34
Water loss (cc.)	10

Mud Summary

Material—	Amount (sacks)
Brinegel	25
Controlgel	60
Controlfiber	13
Hulls	78

Geological Data

Formation tops—	Depth (ft.)
Herrington	2,500
Upper Krider	2,525
Lower Krider	2,545
Winfield	2,580
Fort Riley	2,650
Lower Fort Riley	2,780

Remarks: Drilling is usually routine with no lost-circulation problems.

DRILLING REPORT

KEYES DOME FIELD
Cimarron County, Oklahoma

Pay zone ..... Keyes sand
TD (avg.) ..... 4,800 ft.

Normal Rig-Time Distribution

Days on footage rate	15
Days on day-work rate	2
Total days (spud to rig release)	17

Bit Data

Total number of bits	18
Feet per bit	270

Equipment

Derrick: L. C. M. 126-ft. cantilever.
Draw works: U-15.
Motors (No., hp.): Two at 190 hp.
Pumps: One 7¼ by 15-in.
Fuel: Diesel.
Water supply: Well.
Nearest supply center: Liberal, Kans.
Terrain and roads: Generally level and good.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	9⅝	1,500	600
Oil string	7	4,650	140

Geological Data

Formation tops—	Depth (ft.)
Morrow	4,100
Keyes	4,540
Mississippian	4,620

DRILLING REPORT

QUINDUNO FIELD
Robert County, Texas

Pay zone ..... Brown dolomite
TD (avg.) ..... 4,112 ft.

Equipment

Derrick: 87-ft. cantilever mast.
Draw works: H-40-D or H-40 SC.
Motors (No., hp.): One at 350; two at 200-hp.
Pumps: One 7¼ by 14-in. FXK.
Fuel: Diesel or natural gas.
Water supply: Wells.
Nearest supply center: Pampa, Tex.
Terrain and roads: Dirt roads, passable.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	8⅝	1,120	550
Oil string	5½	4,112	200

Typical Mud Properties

Interval	0-TD
Type mud	Bentonite
Weight (lb./gal.)	10.2
Filter cake (in.)	1/32
Viscosity (sec.)	43
Water loss (cc.)	6

Mud Summary

Material—	Amount
Formaldehyde, lb.	475
Controlgel, sacks	60
Brinegel, sacks	140
Controloid, sacks	110
Hulls, sacks	30
Controlfiber, sacks	20
Soda ash, sacks	2

Geological Data

Formation tops—	Depth (ft.)
Brown dolomite	3,900

Remarks: Lost circulation may occur in the Brown dolomite pay section and it is necessary to condition mud by building up viscosity and adding lost-circulation material.

DRILLING REPORT

CENTRAL KANSAS UPLIFT FIELD
Barton County, Kansas

Pay zone ..... Arbuckle
TD (avg.) ..... 3,000-3,300 ft.

Normal Rig-Time Distribution

Days on footage rate	10
Days on day-work rate	1
Total days (spud to rig release)	11

Bit Data

Total number of bits	8
Feet per bit	400

Equipment

Derrick: 87-ft. cantilever.
Draw works: S-50.
Motors (No., hp.): One WAKU at 200 hp. and one LROU at 350 hp. on the pump.
Pumps: One FXK 7¼ by 14-in.
Fuel: Natural gas or butane.
Water supply: Wells.
Terrain and roads: County roads and section line.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	8⅝	295	170
Oil string	5½	3,290	170

Typical Mud Properties

Interval (ft.)	0-3,300
Weight (lb./gal.)	10.5
Filter cake (in.)	26
Viscosity (sec.)	36-38

Mud Summary

Material—	Amount
Fiberseal, sacks	18
Mylogel, lb.	200
Gelflake, sacks	13
Hulls, lb.	100

Remarks: Drilling on the Central Kansas uplift is fairly routine by now; both cable tools and light rotary rigs are active.

DRILLING REPORT

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The pictures on these pages tell the story. They illustrate the smooth "high road" to offshore drilling barges in the Gulf off Texas and Louisiana.

1. OIL CREWMEN and their baggage are weighed in before boarding an S-55 for a 30-minute flight from the mainland to a barge 45 miles out in the Gulf.

2. S-55 HELICOPTER, loaded with offshore crewmen, takes off from the heliport on a Grand Isle office parking lot.

3. THIRTY MINUTES later the Sikorsky comes in for a gentle landing on the flight deck 45 miles from Grand Isle, Louisiana. By boat, the trip takes tiresome hours.

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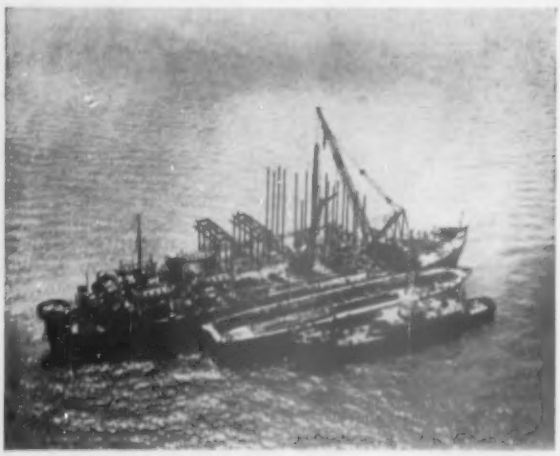

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Eastern United States

APPALACHIAN GAS FIELDS
(Drilling with air or gas)
Central Pennsylvania

Pay zone ..... Oriskany sandstone
TD (avg.) ..... 6,500 ft.

Cost Data

Day-work rate with drill pipe $900-1,050

Normal Rig-Time Distribution

Days on footage rate	21
Days on day-work rate	4
Total days (spud to rig release)	25

Bit Data

Total number of bits	20-25
Feet per bit	290

Equipment

Derrick: 126-ft. jackknife.
Draw works: Unit 15, Oilwell 66, or National 175.
Motors (No., hp.): Two at 200 hp.
Pumps: Two 7¼ by 14 in.
Fuel: Natural gas and propane.
Water supply: Ponds, streams, wells.
Terrain and roads: Mountainous terrain; roads muddy and impassable in the spring.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	13	40	200
Intermediate	9⅝ or 10¾	600-800	275
Oil string	5½ or 7	6,450	100

Geological Data

	Depth (ft.)
Formation tops—	
Oriskany sandstone	6,450

Remarks: Drilling with gas or air is becoming more popular in the Appalachian gas fields. Drilling time is reduced from 30 to 22 days and total number of bits reduced from 36 to 20 to 25. Operators set pipe on top of pay and drill in.

DRILLING REPORT

APPALACHIAN GAS FIELDS
Central Pennsylvania

Pay zone ..... Oriskany sandstone
TD (avg.) ..... 6,500 ft.

Cost Data

Day-work rate with drill pipe $900-1,050

Normal Rig-Time Distribution

Days on footage rate	28
Days on day-work rate	3
Total days (spud to rig release)	31

Bit Data

Total number of bits	37
Feet per bit	176

Equipment

Derrick: Jackknife.
Draw works: Unit 15, Oilwell 66, National 75.
Motors (No., hp.): Two at 200 hp.
Pumps: One at 7¼ by 15 in.
Fuel: Natural gas and propane.
Water supply: Ponds, streams, wells.
Terrain and roads: Mountainous terrain; roads passable except in spring thaws.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	13	40	200
Intermediate	9⅝ or 10¾	600-800	275
Oil string	5½ or 7	6,450	250

Geological Data

	Depth (ft.)
Formation tops—	
Top Oriskany sandstone	6,450

Contractors using water normally mud up before drilling through the Oriskany. Lost circulation is a problem, especially in shallow zones. Holes drilled close to the major faults encounter trouble with material caving into well bore.

DRILLING REPORT

ILLINOIS BASIN
Illinois

Pay zone ..... Chester series
TD (avg.) ..... 2,600 ft.

Cost Data

Footage price	$3.75
Day-work rate with drill pipe	400.00

Normal Rig-Time Distribution

Days on footage rate	11
Days on day-work rate	1
Total days (spud to rig release)	12

Reduce Engine Costs
Eliminate Expensive Power Drives

with **FUNK** Standard Gear Reduction Power Take-Offs

Small, popular-make high speed engines equipped with Funk Gear Reductions develop the same power output, at substantial savings over large, expensive slow speed engines. Service availability is also an important factor. A gear reduction with reduced speed output shaft eliminates expensive V-belt and chain drives. Safer, too.

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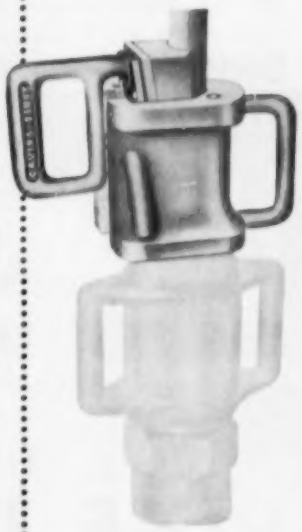

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Equipment

Light rotary rigs or cable tools.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	120	125
Oil string	7	2,600	250

Typical Mud Properties

Interval (ft.)	2,000-TD
Type mud	Water base
Weight (lb./gal.)	9.7
Viscosity (sec.)	42
Water loss (cc.)	5.8

Mud Summary

Material—	Amount
Gel, sacks	115
Quebracho, lb.	500
Caustic soda, lb.	250
Driscose, lb.	100

DRILLING REPORT

Mississippi

BOLTON FIELD
Hinds County, Mississippi

Pay zone	Paluxy sand
TD (avg.)	9,940-10,000 ft.

Cost Data

Footage price	No established price

Normal Rig-Time Distribution

Days on footage rate	29
Days on day-work rate	10
Total days (spud to rig release)	39

Bit Data

Total number of bits	32
Feet per bit	310

Equipment

Derrick: Lee C. Moore 144-ft. mast.
Draw works: Oilwell "96."
Motors (No., hp.): Two G.M. Quads; one G.M. Twin both 1,300 hp.
Pumps: One 20-in.; one 14-in.
Fuel: Diesel.
Water supply: Water well.
Nearest supply center: Brookhaven, Miss.
Terrain and roads: Good.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	1,500	1,000
Oil string	5½	9,950	600

Mud Summary

Gel mud used to total depth; mud cost approximately $5,000.

Geological Data

Formation tops—	Depth (ft.)
Wilcox	2,560
Gas rock	4,670
Base of chalk	6,090
Lower Tuscaloosa	7,710
Lower Cretaceous	7,960
Top of pay	9,920

DRILLING REPORT

MAXIE-PISTOL RIDGE FIELD
Forest and Pearl Counties, Mississippi

Pay zone	Tuscaloosa
TD (avg.)	8,600 ft.

Cost Data

Footage price	$4.45
Day-work rate with drill pipe	800-850
Day-work rate without drill pipe	750-775

Normal Rig-Time Distribution

Days on footage rate	22
Days on day-work rate	22
Total days (spud to rig release)	44

Equipment

Derrick: 136-ft. (10-ft. substructure).
Draw works: National 75 (10,000-ft. capacity with 4½-in. drill pipe).
Motors (No., hp.): Three NKU's at 300 hp.
Pumps: One C-250 7¼ by 15-in. and one GD 7¾ by 16-in.
Fuel: Gas.
Water supply: Well or creek.
Nearest supply center: Laurel, Miss.
Terrain and roads: Board roads; rain makes moves impossible.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	1,000	62.5
Oil string	5½	8,600	500

DRILLING REPORT

Canada

PEMBINA FIELD
Alberta, Canada

Pay zone	Cardium sandstone
TD (avg.)	5,200-5,300 ft.

Cost Data

Footage price	$4.50
Day-work rate with drill pipe	815.00
Day-work rate without drill pipe	815.00
Days on footage rate (12 drilling days)	18
Days on day-work rate	3
Total days (spud to rig release)	21

Bit Data

Total number of bits	14
Feet per bit	380

Equipment

Derrick: 126-ft. cantilever mast.
Draw works: Cardwell "O."
Motors (No., hp.): Three at 200 hp.
Pumps: One 7¼ by 16 in.
Fuel: Diesel.
Water supply: Local hauling and ponds.
Nearest supply center: Edmonton.
Terrain and roads: Low and muddy in summer.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	600	375
Oil string	5½	5,200	500

Geological Data

Formation tops—	Depth (ft.)
Edmonton	1,300
Belly River	3,220
Lea Park	4,070
Colorado	4,490

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GASO PUMPS

for every oil industry need

Cardium	5,010
Oil sand	5,085

Remarks: Weather is the most difficult problem at Pembina, because spring thaws and summer rains seriously curtail operations. Operators have considered confining development drilling to the winter months.

DRILLING REPORT

PIGEON LAKE AREA
Alberta, Canada

Pay zone ..... Leduc limestone (formerly "D3" zone)
TD (avg.) ..... 7,250 ft.

Cost Data

Footage price	$7.50
Day-work rate with drill pipe	825.00
Day-work rate without drill pipe	775.00

Normal Rig-Time Distribution

Days on footage rate (25 drilling days)	35
Days on day-work rate	9
Total days (spud to rig release)	44

Bit Data

Total number of bits	34
Feet per bit	210

Equipment

Derrick: 131-ft. cantilever mast.
Draw works: U-15.
Motors (No., hp.): Three at 200 hp.
Pumps: One 7¼ by 14 in. and one 7¾ by 16 in.
Fuel: Diesel.
Water supply: Local hauling.
Nearest supply center: Edmonton.
Terrain and roads: Fair.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	620	400
Oil string	7	7,250	450

Geological Data

Formation tops—	Depth (ft.)
Lea Park	2,980
Colorado group	3,490
Base Fish Scale zone	4,640
Viking	4,780
Blairmore	4,940
Ostracod zone	5,430
Basal quartz sandstone	5,450
Banff	5,600
Exshaw	5,710
Wabamu	5,730
Calmar	6,410
Nisku	6,440
Treton	6,604
Leduc	7,140

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signals the passage of all pipeline scrapers

PIG SIG

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1. WELD the housing to pipe.
2. DRILL a hole into pipe with Tapping Machine.

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PIG-SIGS cut operating costs . . .
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CLEANS PIPE LINES
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DRILLING REPORT

WEST DRUMHELLER FIELD
Southern Alberta, Canada

Pay zone ..... Nisku (D3)
TD (avg.) ..... 5,600 ft.

Cost Data

Footage price	$5.50
Day-work rate with drill pipe	840.00
Day-work rate without drill pipe	770.00

Normal Rig-Time Distribution

Days on footage rate (16 drilling days)	23
Days on day-work rate	6
Total days (spud to rig release)	29

Bit Data

Total number of bits	23
Feet per bit	240

Equipment

Derrick: 131-ft. cantilever mast.
Draw works: U-15.
Motor (No., hp.): Three at 200 hp.
Pumps: One 7¼ by 14 and one 7¾ by 16 in.
Fuel: Diesel.
Water supply: Local hauling.
Nearest supply center: Stettler.
Terrain and roads: Fair.

Casing Program

	O.d. (in.)	Casing seat (ft.)	Cement (sacks)
Surface	10¾	750	550
Oil string	7 or-5½	5,600	550

Geological Data

Formation tops—	Depth (ft.)
Colorado	2,550
Second white speckled shale	3,450
Base Fish Scale zone	3,750
Viking	3,870
Blairmore	4,120
Rundle	4,640
Banff	4,810
Exshaw	5,000
Three Forks	5,020
Potlatch anhydrite	5,040
Calmar	5,530
Nisku equivalent	5,540

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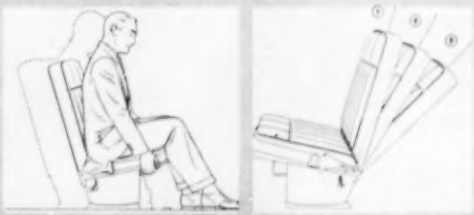

Individual chairs with reclining backs adjust fore and aft for added comfort — leg room.

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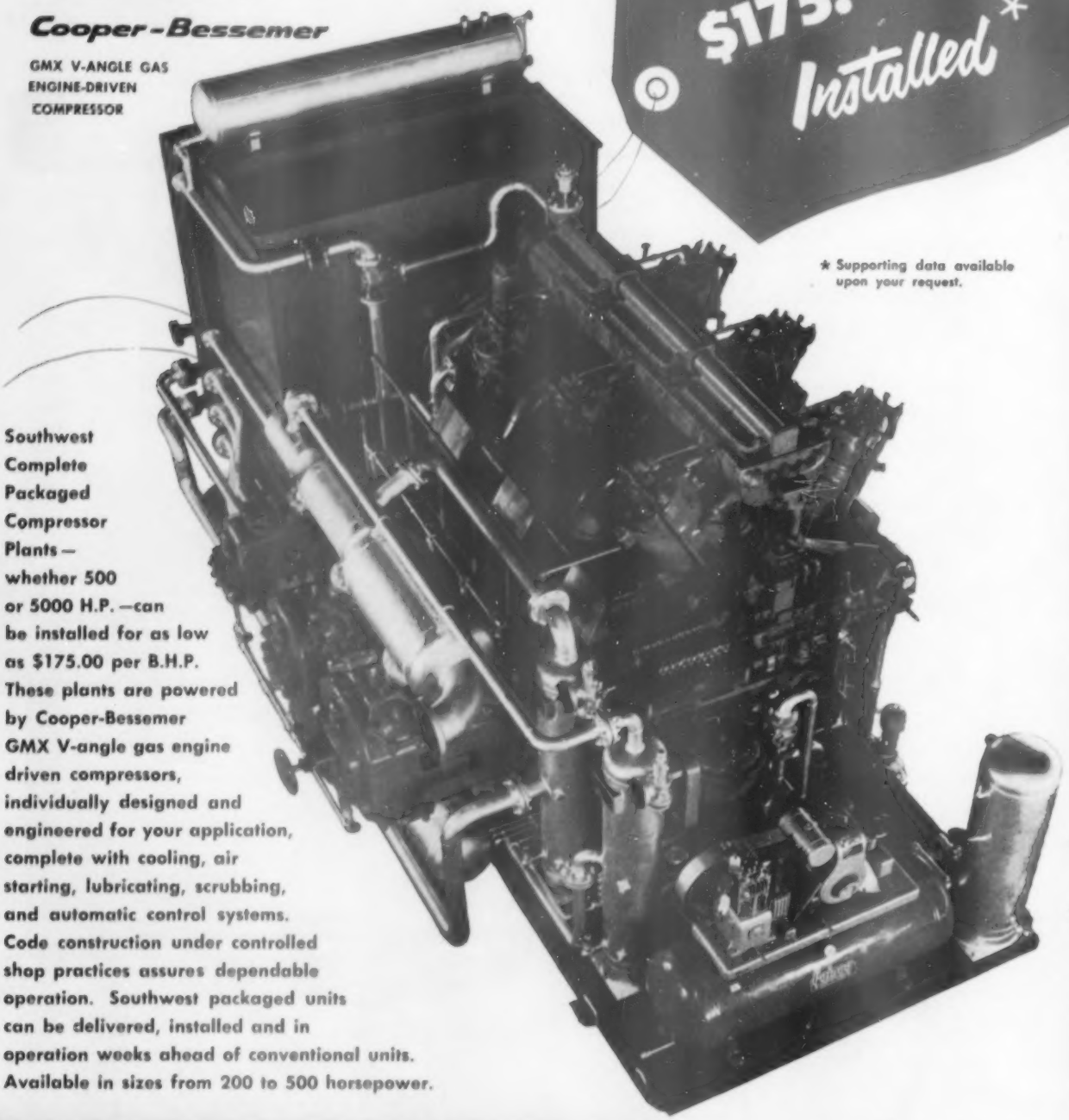

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How to Design In-Tank Jet Mixing Systems—4

This installment is the introduction to a series of equations and nomographs which offer simplified methods of design procedure. All figures referred to here will be presented in future installments.

THE object of this and succeeding installments is to present an accurate, quick, and simple method for designing in-tank jet mixers. The basic mathematics, theory, and supporting evidence have been covered in published articles.[1,2,3] Two design procedures are given: the first, presented in this installment, is for solving the problem of mixing TEL with gasoline, while the second is for solving general mixing problems. Nomographs used in the design, and the equations on which the nomographs are based, will be given in later installments.

Mixing TEL in Gasoline

A calculation sheet for the design of in-tank jet mixers will also be presented later. Following this sheet will allow rapid straightforward determination of the factors needed for jet design: nozzle inclination angle; nozzle diameter; nozzle thrust; and total mixing time.

An example will be presented on the calculation sheet for illustration.

The following variables must be known for existing installations or be assumed for facilities in the design stage:

1. Blending-tank capacity.
2. Blending-tank liquid level.
3. Blending-tank diameter.
4. Rated gasoline-circulating pump capacity.
5. Rated gasoline-circulating pump head.
6. Desired TEL addition time.
7. Pipeline friction losses.
8. Static heads on the pump.

Design steps . . . Here are the design steps to be followed in solving the problem of mixing TEL with gasoline.

A. The first unknown to be determined is the most satisfactory nozzle inclination angle. This may be found with Fig. 3 knowing blending-tank liquid level and diameter. This angle is not critical and if later calculations show that the minimum head required to prevent stratification is not available for this determined angle, it may be increased. However, the minimum satisfactory angle should be used to allow the jet to be operated at low liquid levels without breaking the surface.

B. Now determine the height of nozzle in the tank. In an existing tank, the nozzle may have to be located in a position specified by present construction. The height of the nozzle should preferably be about 2 ft. from the bottom of the tank.

C. The nozzle submersion can now be found by subtracting the nozzle height from the maximum liquid level.

D. Then, using the alignment chart in Fig. 4, the lead concentration in the circulating stream of the gasoline going to the jet nozzle may be found. This is the lead concentration assuming all the gasoline in the tank is being leaded to 3 cc. per gal. for motor fuel or 4.6 cc. per gal. for aviation fuel, the most severe conditions encountered, and will result in the most conservative figures for jet-nozzle design.

E. Fig. 5 will then give the minimum head to prevent stratification. This head must be exceeded by the net excess head available at the nozzle, as calculated in F, if jet mixing is to be satisfactory. A reasonable safety factor should be included in this comparison.

F. The net excess head available at the nozzle must be calculated next. First, the pressure drop in the circulating-pump pipeline must be calculated. This may be done knowing the pipe sizes, flow rates, and total equivalent length of pipe, making allowance for all fittings, valves, etc., by the standard methods presented in handbooks. Using the procedure outlined on the calculation sheet, the net excess head that is available at the nozzle is obtained. This is the actual head that may be consumed by the nozzle in creating turbulence to mix the blending tank.

G. The calculated mixing time may be determined from Fig. 6. This is the time required for mixing a tank to a uniform condition. Since mixing occurs during the time TEL is being added and gasoline circulated to the tank, it is not the time the tank must be circulated after TEL addition is completed.

H. The actual total circulating time (including both time for addition of TEL and subsequent mixing) is equal to either the calculated mixing time or the desired TEL addition time plus half of the calculated mixing time, whichever is greater.

I. Nozzle diameter may be found with Fig. 7.

J. Nozzle thrust may be found with Fig. 8. This is the backward force exerted by the nozzle and must be absorbed by the nozzle supports.

This material from E. I. du Pont de Nemours & Co., Inc.

Bibliography

1. "Some Notes on the Use of Free Jets for the Mixing of Fluids in Bulk," by H. Fossett.

2. "The Application of Free Jets to the Mixing of Fluids in Bulk," by H. Fossett and L. E. Prosser, M.I.Mech.E. and published in Proc. I. Mech. E., 1949, vol. 160, p. 128.

3. "The Action of Free Jets in the Mixing of Fluids," by H. Fossett, presented to the Institution of Chemical Engineers, July 17, 1951.

Applying Spectroscopy in Petroleum Analysis—2

by R. C. Pomatti, R. F. Meeker, and Harry Levin

ON absorption spectroscopy the different wave lengths which enter the sample are absorbed in different degrees. The plot of absorbance (or its converse, transmission) against wave length is called the absorption spectrogram. (Fig. 3 shows the ultraviolet absorption spectrogram of toluene and Fig. 4 the infrared spectrogram of 2, 3, 4 trimethylpentane). The portions of interest are the absorption bands, regions where the sample has absorbed strongly.

In qualitative analysis it is necessary, for reference purposes, to have a library of absorption spectrograms of known compounds. Knowledge of the history of the sample often saves much time in interpreting spectrograms. In analyzing an unknown consisting of one compound, positive identification is made if the spectrogram of the unknown matches one from the library of knowns.

It is not always possible to identify each compound in a multicomponent sample because the spectra of the compounds are additive and the resultant spectrum of the sample therefore may be very complex. However, valuable information can still be obtained as to types of compounds present since certain organic radicals have characteristic absorption bands regardless of the structure of the rest of the compound.

Fig. 5 illustrates the information that can be derived from an infrared spectrogram of a sample even though the individual compounds might not be identified. The absorption at 2.9μ indicates a hydroxyl group, the band at 5.9 shows a carbonyl group, 6.1μ indicates olefins, and 6.2 aromatics. The sample actually is a mixture of diisobutylene, m-cresol, and methyl ethyl ketone.

Authors are with The Texas Co., Beacon Laboratories, Beacon, N. Y.

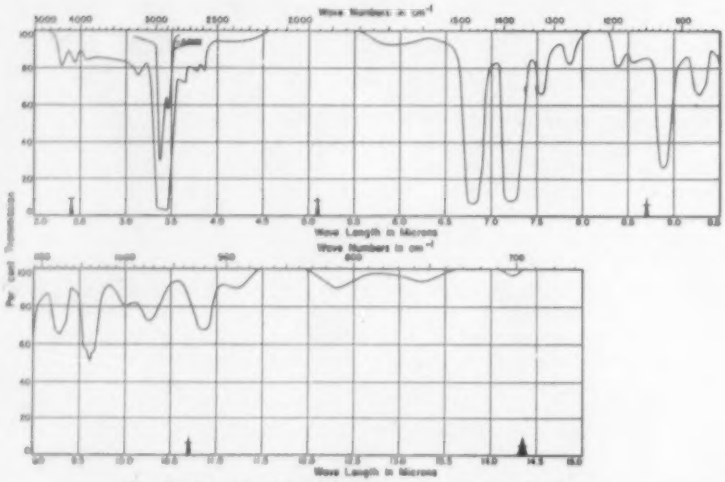

Fig. 3—An ultraviolet absorption spectrogram of toluene.

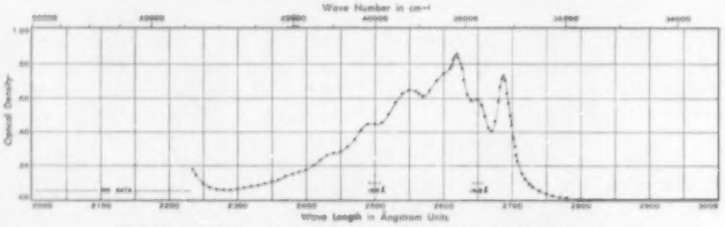

Fig. 4—An infrared spectrogram of 2,3,4-trimethylpentane.

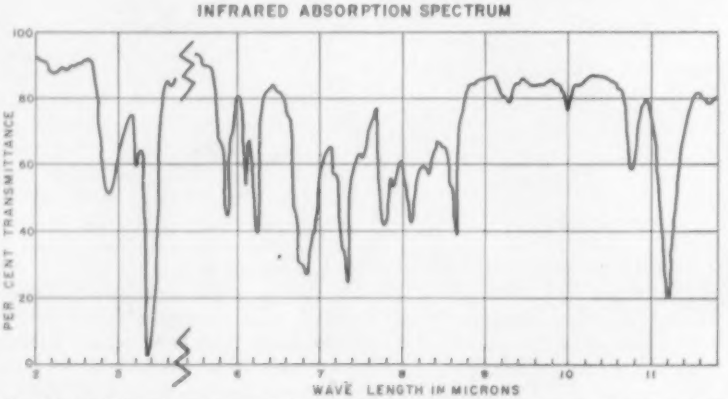

Fig. 5—An infrared spectrogram of a mixture of diisobutylene, m-cresol, and methyl ethyl ketone.

by W. L. Nelson
Technical Editor

QUESTIONS ON TECHNOLOGY

Quality of World Competitive Crudes

"There are so many crude oils that we find difficulty in comparing them. Can you state the average properties of various world competitive crude oils for comparison?"—A.G.P.

Unless whole regions are to be compared, averages are not of much value. Crude oils from each field and especially those from each general region, vary so widely that it is usually necessary to compare specific oils with one another. Nevertheless, Table 1 indicates some of the main properties of average crude oils. Note that the range of gravity is large in most areas.

With respect to the octane number of gasoline (both straightrun and cracked), typical Gulf Coast oils are the best although the yield of gasoline is lower than with other crude oils. The octane numbers of California, Venezuela, and East Texas gasolines are also excellent, whereas Middle East, West Texas, and Mississippi (heavy crude) gasolines are inferior.

Only Venezuelan crude oils can produce large yields of diesel fuels that have both a low pour point and a good ingition quality, although West Texas diesel fuels are nearly equal to Venezuelan fuels. Diesel fuels from Middle East, East Texas, and Mississippi crude oils have too high pour points whereas those from California and the Gulf Coast area lack ignition quality. Of course, excellent diesel fuels can be produced from the inferior crude oils but at a sacrifice in yield or by incurring treating costs.

Mississippi and Middle East crude oils contain much more sulfur than other oils (especially if compared with oils of the same gravity) and those from East Texas and the Gulf Coast are nearly free of sulfur.

West Texas and Middle East crude oils contain dissolved hydrogen sulfide and are therefore corrosive. However, the degree of sourness of the Middle East oils is so small that it can be corrected to a large extent by a simple stabilization operation in the field. None of the oils of Venezuela, East Texas, the Gulf Coast, Mississippi, or California is classed as "sour."

With respect to general boiling range, all crude oils except those of the Gulf Coast have substantially the same boiling range. This means that the yields of products in each boiling range are nearly the same. Gulf Coast oils have very narrow boiling ranges (large yields of middle distillate or cracking stocks).

This department was created for the purpose of aiding managers, superintendents, engineers, chemists, and all those engaged in various phases of plant operation, as well as those connected with the marketing and utilization of petroleum products. Readers are invited to submit their problems to W. L. Nelson, technical editor. Inquiries must be signed, but only the initials will be printed.

Relation of Salt to B.s. and w. Content

"What is the reelationship of salt content to b.s. and w. content?" Wm.S.P.

There is no real relationship at all. The amount of water in the "sediment and water" is greatly affected by small amounts of wax, dirt, scale, etc., and the water in the "sediment and water" may not contain much salt. Only the small amount of information tabulated here (based on only 41 Venezuelan oils and 23 others) is available:

	Lb. NaCl per 1,000 bbl.	
B.s. and w.:	U.S. oils	Venezuelan oils
0.1	6	3
0.2	24	4
0.4	140	4
1.0	770	5
2.0	1,800	12

Variations are great in every region.

TABLE 1—COMPARISON OF AVERAGE WORLD COMPETITIVE CRUDE OILS

	United States	Venezuela	California	Mississippi (heavy)	Typical coastal	Middle East	West Texas	East Texas
Gravity, average, A.P.I. (1951)	34.7	25.3	26.2	29.8	31.5	35.8	37.2	*38.0
Gravity, main range	16-45	13-40	12-40	13-40	21-37	28-40	25-50	36-40
Sulfur, average per cent	0.75	1.36	1.05	*1.60	0.19	1.60	1.38	0.26
Sulfur, per cent in 15° A.P.I. oils	1.89	2.22	1.78	3.5	...	...	...	...
Sulfur, per cent in 25° A.P.I. oils	1.26	1.39	0.98	1.92	0.17	...	...	...
Sulfur, per cent in 35° A.P.I. oils	0.54	0.50	...	...	0.12	1.59	0.65	0.28
Sulfur, per cent in 45° A.P.I. oils	0.20	0.11	...	...	...	...	0.17	...
Sour (corrosive)	...	No	No	No	No	Yes†	Yes	No
Oct. No. with 3 cc. TEL, straightrun‡	...	77	*78	*52	83	62	64	78
Oct. No. (MM), cracked‡	...	70	70	*69	70	68	67	67
Diesel fuel, pour point, °F.‡	...	—2	*17	*38	¶45	17	7	15
Diesel fuel, diesel index‡	...	48	*43	*52	39	57	59	58
Gasoline, per cent in 25° A.P.I. oil§	...	41.7	43.2	41.0	37.8	...	42.8	...
Gasoline, per cent in 35° A.P.I. oil§	...	54.6	...	...	50.9	55.1	55.3	*58.2

*Estimate. †But free hydrogen sulfide is usually removed before shipment. ‡Of product contained in crude oil of average gravity. §Total of straightrun to 400° F. and thermally cracked gasoline. ¶Below.

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Drilling Contractors

M. H. Marr, El Dorado, Ark., has taken a contract for a 2,700-ft. test at a wildcat location northeast of Waldo, in Columbia County, southern Arkansas. Bruce Brian, of Cullendale, Ark., and Larry Drewery, of Camden, are the operators. The test is at 1 Jackson, in 10-16s-21w.

Rocket Drilling Co. is under contract to Dozier Oil Co. for two wildcat tests in eastern McPherson County, Kansas. One, 1 Anderson, in 18-19s-1w, 2 miles northwest of Canton, and ¾ mile from Jenday pool, is making hole. The other, 1 Sand, in 9-18s-2w, 9 miles northeast of McPherson and 1½ miles south of Bonaville pool, is a location.

W. J. Coppinger has a rig working for Cities Service Oil Co. on a deep wildcat test in southwestern Barber County, Kansas. Location is at 1 Walgamott, in 16-35s-14w. It is 6 miles southeast of Aetna pool, and just 330 ft. from the Oklahoma line.

Anschutz Drilling Co., Wichita, Kans., is drilling on a deep wildcat test east of the Black Mountain area, in southern Washakie County, Wyoming. It is a contract job for Cyprus Mines at 1 Muirhead, in 25-43n-90w.

Guy Mabee Drilling Co., Midland, Tex., has a rig on a wildcat location 5 miles southeast of Woodrow, in western Washington County, northeastern Colorado, where it is drilling for Oklahoma Oil Co. Location is for 1 Ward, in 34-1s-55w.

Bob Olds Oil Co. has contracted a rig to Hawks & Crafts for a wildcat test in the Kuemerle area, of Weston County, Wyoming. The test, now drilling, is 1 Government, in 8-45n-64w.

Gilger Drilling Co., Houston, is scheduled for a 12,000-ft. test on the northeast flank of the Anse La Butte dome, in St. Martin Parish, Louisiana Gulf Coast. It is a contract job for Austral Oil Exploration Co., Inc., also of Houston, at 1 Babb et al., in 115-9s-5e.

Circle Drilling Co., Lake Charles, La., has the contract for the deep test Sohio Petroleum Co., Tide Water Associated Oil Co., and Welsh Estate have projected for the previously untested northwest flank of the old Bayou

On the floor of one of Ira Henderson's rigs drilling for Wilson Oil Co. in Humble field, northern Harris County, Texas Gulf Coast. Standing, left to right: A. L. Stasdney, driller; Ira Henderson, contractor; William Underwood, Mission Manufacturing Co. representative; C. J. Williamson, superintendent, Wilson Oil Co.; and B. D. Lawrence, helper. Front, same order: R. E. Cunningham and Leonard Goss, helpers. (Photo by courtesy of Mission Manufacturing Co., Houston.)

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Corpus Christi

Boullion dome, in St. Martin Parish, Louisiana Gulf Coast. The test will be drilled as 1 Lucie Martin et al. Hole is scheduled to be carried to 11,000 ft.

Brewster-Bartle Drilling Co., Houston, is on a 9,000-ft. southwest extension test Gulf Refining Co. is putting down in the Timbalier Bay area, Lafourche Parish, Louisiana Gulf Coast.

Paul Sluder is contractor on a 4,000-ft. wildcat test Neil McDowell, of Houston, is undertaking 7¾ miles northwest of Cameron, in Milam County, Central Texas. Location is for 1 Fuller, in the Jose Antonio Pena Survey.

Survey Drilling Co., Dallas, is under contract to Gulf Refining Co. for a Lower Cretaceous exploratory test near Silas, 7 miles south of Gilbertown field, in Choctaw County, western Alabama. Location is at 1 Dubose, in 7-9n-3w.

Rogers Drilling Co. has a new wildcat operation under way 9 miles northwest of Dix, in Kimball County, Nebraska. It is drilling for Joseph E. Burke, Jr., and Howard Chamlee. Location is at 1 McMurray, in 25-16n-55w.

Crow Drilling Co., Inc., Shreveport, has a rig under contract to W. L. Billups and Gauthier & Heard, of Natchez, Miss., for a Wilcox test to be drilled at an outpost location southeast of Clayton field, in Concordia Parish, eastern Louisiana. Location is for 2 Hughes, in 49-8n-10e. Contract is for 6,000 ft.

Petersen Drilling Co., Shreveport, has a new contract with Durbin Bond & Co., of Little Rock, for a 6,200-ft. Wilcox test to be drilled at 1 Calvert-Cotton Unit, in 36-7n-6e, Catahoula Parish, eastern Louisiana. Location is about 2 miles north of Willow Lake field, in Catahoula Parish, and 3¼ miles south of Wildsville field, in Concordia Parish.

Penrod Drilling Co., Shreveport, has scheduled a Smackover test to be drilled for Hassie Hunt, Trust, of Dallas, in the northern part of North Lisbon field, Claiborne Parish, North Louisiana. Objective is expected around 10,700 ft. Location of the test, 1 Tanner-Thompson et al., in 28-22n-4w, is about 4 miles northeast of the field's Smackover discovery well, and about 3¾ miles southeast of the Smackover discovery well of Summerfield field. Production in the immediate area is from the Cotton Valley horizon.

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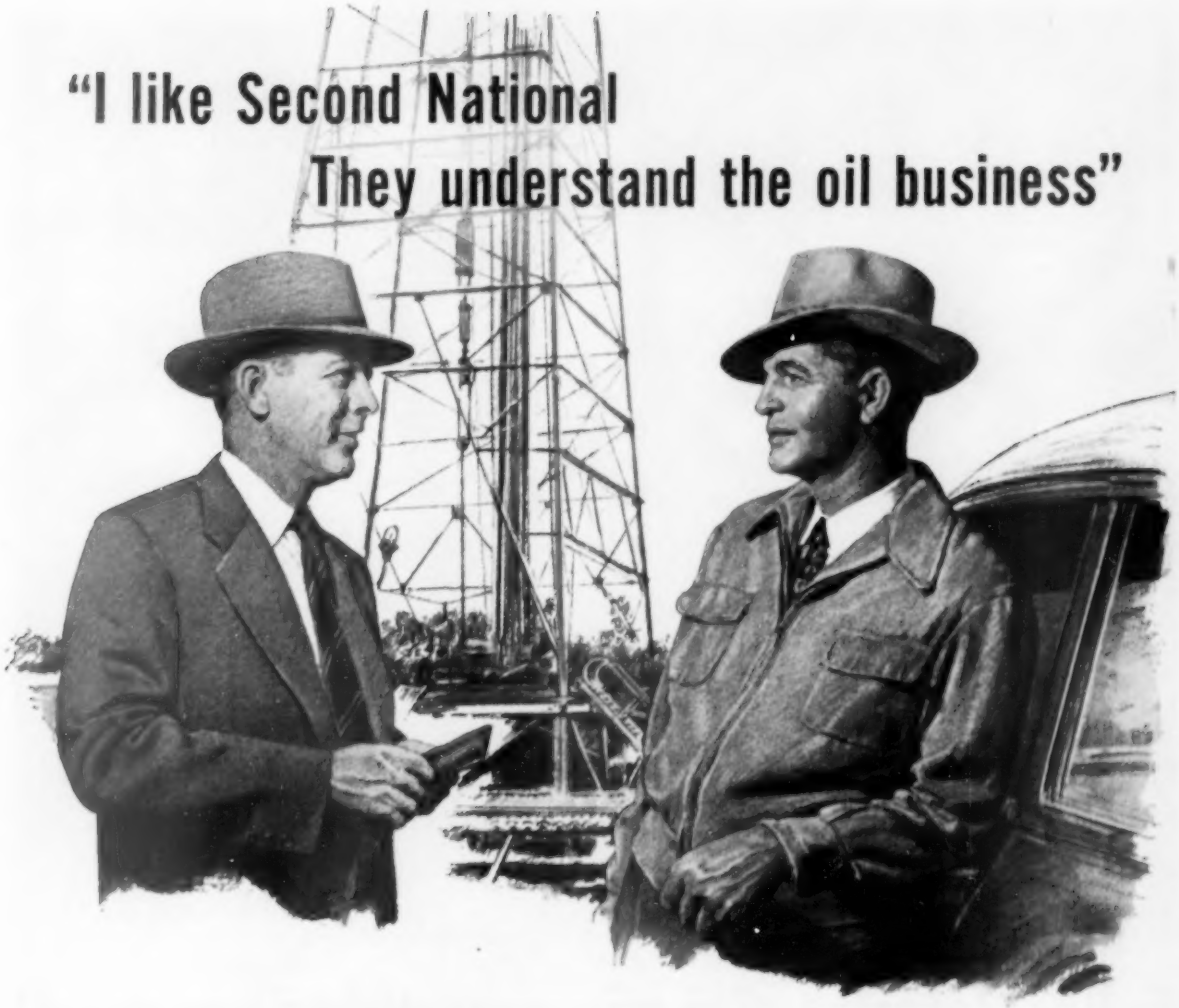

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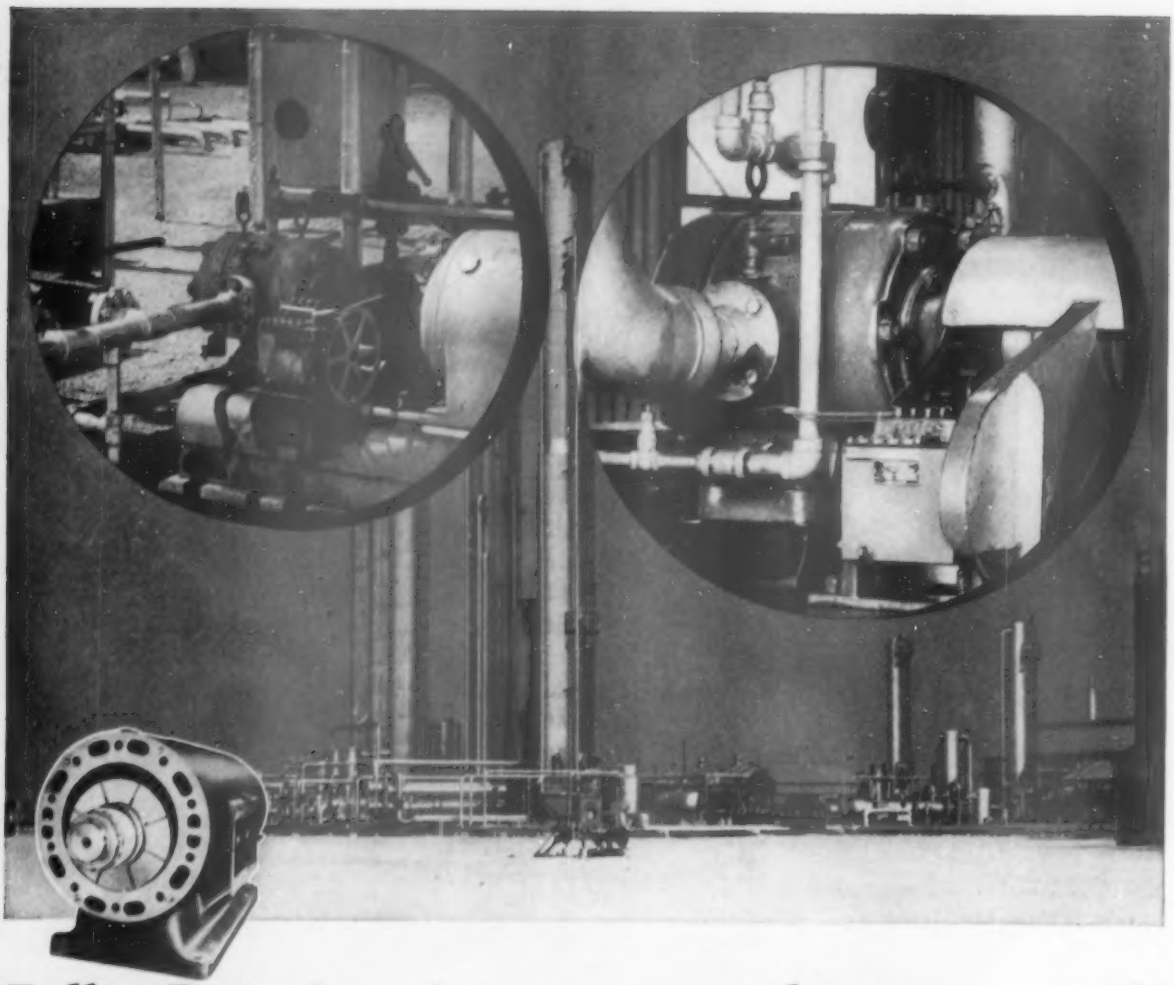

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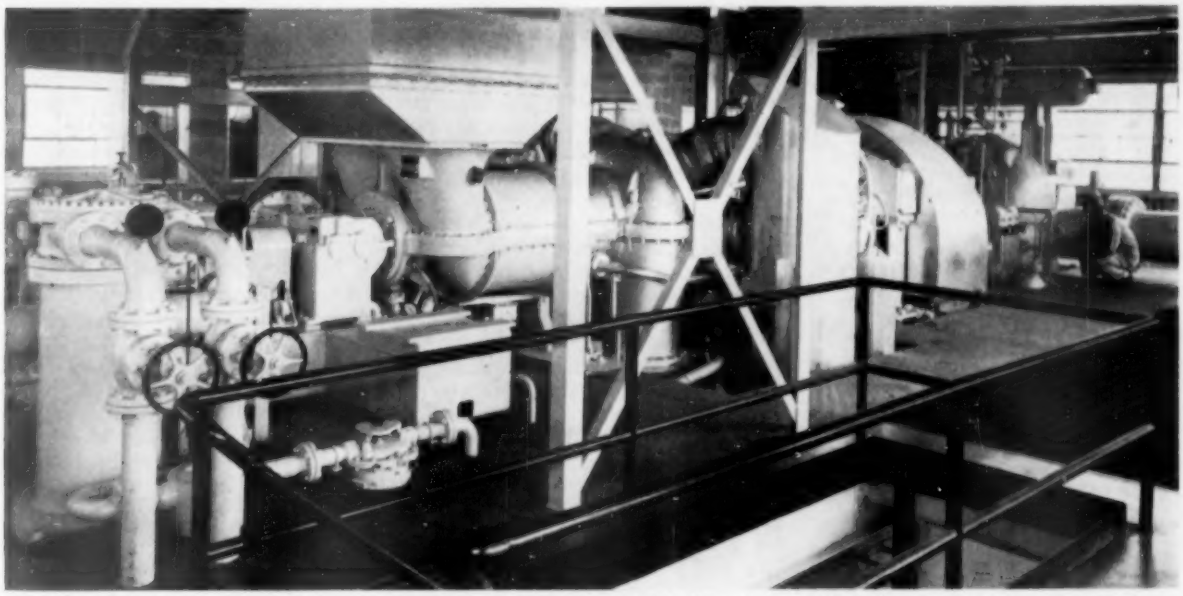


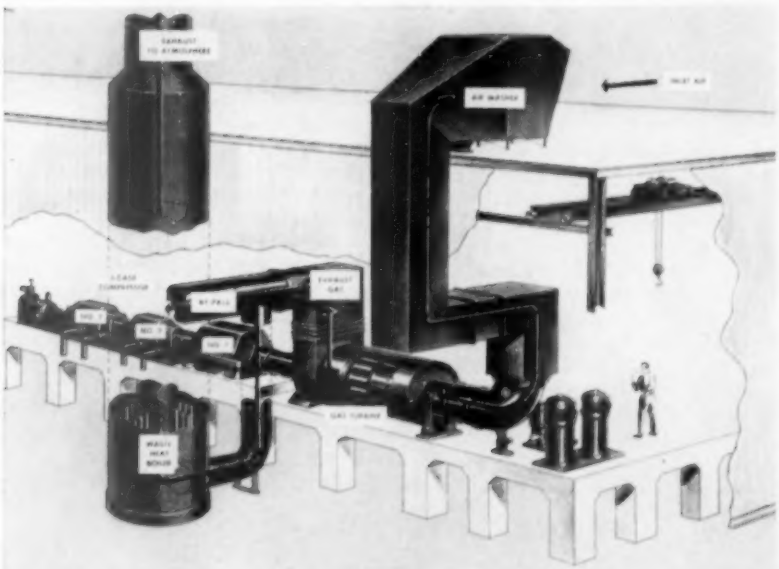
GAS-TURBINE and centrifugal-compressor installation at the Napoleonville, La., station of United Gas Pipe Line Co., Fig. 1.

Higher ratings plus good record promise . . .

Greater use ahead for gas turbines

by E. C. Clark

A SUBSTANTIAL increase in the power-output rating of gas turbines and the accumulation of thousands of hours of successful operating time by units in pipeline service have materially enhanced the position of the gas turbine from an economic standpoint. The combination of the two factors may pave the way for a great increase within the next few years in the use of combustion gas turbines for driving pipeline compressors.



CUTAWAY of typical gas-turbine installation with provisions for utilizing heat from exhaust gases, Fig. 2.

The increase in rating of the turbines has been a result of improved design and has not been accompanied by an increase in initial cost of individual units. Looking at it another way, this uprating, amounting to about 25 per cent, means greater output at less cost-per-unit power—further strengthening the economic position.

Hundreds of thousands of hours of operating experience have been amassed by members of the pipeline industry since the first gas turbines were installed a few short years ago. This experience has proved that the turbine is a very practical driver for compressors, is capable of sustained operation at full loads, and has certain features which make it very attractive for specific pipeline problems.

Better design . . . Experience and technological know-how gained by research on the part of manufacturers and users alike have made possible the increase in various turbine ratings. As an example, simple cycle turbines which were originally rated at 3,500 kw. or 5,000

Author is engineer with General Electric Co., Apparatus Sales Division.

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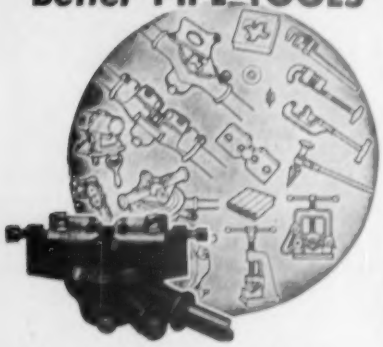

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hp. have been uprated to 5,000 kw. or 7,000 hp. Units with compound cycles have had an increase in ratings almost as great. These higher ratings are a direct result of better engineering, better materials, and improved design. They have been made without sacrificing reliability or quality or without increasing unit cost to the user.

Newer models have been improved further from an installation standpoint by mounting of the turbines on steel bases at the factory and shipping the units with factory-assembled piping, oil tank, and wiring. This enables the base to become a permanent part of the unit foundation and reduces the cost for the over-all installation.

As it now stands, the combustion gas turbine is a self-contained prime mover and as such, is suitable for installation in isolated locations as well as on interconnected systems. The entire unit, very compact for its horsepower, has the characteristics of being mechanically simple, easily started, operable with a minimum of cooling water, and capable of delivering greatly increased output under conditions of low ambient temperatures. With high winter demands, this latter feature is particularly appealing to gas pipeline operators.

Hours piling up . . . The fact that turbines require a minimum of cooling water was an important factor in their choice by El Paso Natural Gas Co. for use in booster stations on the Texas-California system of that company. Twenty-eight gas turbines in operation on that system represent the first large-scale application for pipeline pumping.

Why balance initial pressures?

by V. E. Ford

THE effect of unbalanced initial pressures in power cylinders of two-cycle engines can be extremely detrimental to engine performance as well as maintenance. Unbalanced initial or explosion pressure results in uneven distribution of developed horsepower, increased ring and cylinder wear, and possible detonation and consequent burning of pistons and scoring of cylinder walls.

To avoid this, it is very important that injection valves, ignition systems, scavenging valves, and ports be kept clean and in good condition and that periodic checks be made on the explosion pressure of individual cylinders with an explosion pressure indicator.

Pressure vs. horsepower . . . Both two-cycle and four-cycle engines are designed to operate continuously at a given maximum-rated load, with a reasonable amount of overload capacity built into them to take care of temporary emergencies for reasonable lengths of time. The designed rating is, of course, based on each cylinder doing its share of the work. Since there is a definite relation between initial or explosion pressures in the power cylinders and the horsepower being developed, it is extremely important that a reasonably good balance of initial pressures be maintained if the best and most economical operation is to be expected.

Author is with Clark Brothers Co., Tulsa. Paper presented before N.G.A.A. Permian Basin regional meeting, Odessa, Tex.

Inasmuch as the supply of air to the cylinders of two-cycle engines remains constant for any given speed and the speed is controlled by varying the amount of fuel that is fed to the individual cylinders, it can readily be seen that an engine running on a light load will be running on a rather lean mixture and will have a tendency to misfire. When an engine is running under such conditions, it is impossible and unnecessary to try to maintain balanced initial or explosion pressures. However, any engine running at around 80 per cent of rated load or better should be kept well balanced.

Effects of unbalance . . . Any time that one or more cylinders fail to receive their proper share of the fuel, this cylinder or cylinders will be underloaded, which will be indicated by low explosion pressures. This means that the remaining cylinders must not only carry their share of the load, but must also carry additional load to compensate for those that are underloaded.

If an engine is running unbalanced and a sudden load change should occur that would necessitate its carrying a temporary overload, it would be questionable whether or not the engine would be able to keep running. If it did keep running, there would be some cylinders running at an excessive overload and extremely high explosion pressures. The additional heat generated in the heavily loaded cylinders will naturally have a tendency to burn the lu-

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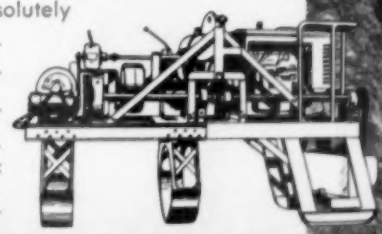

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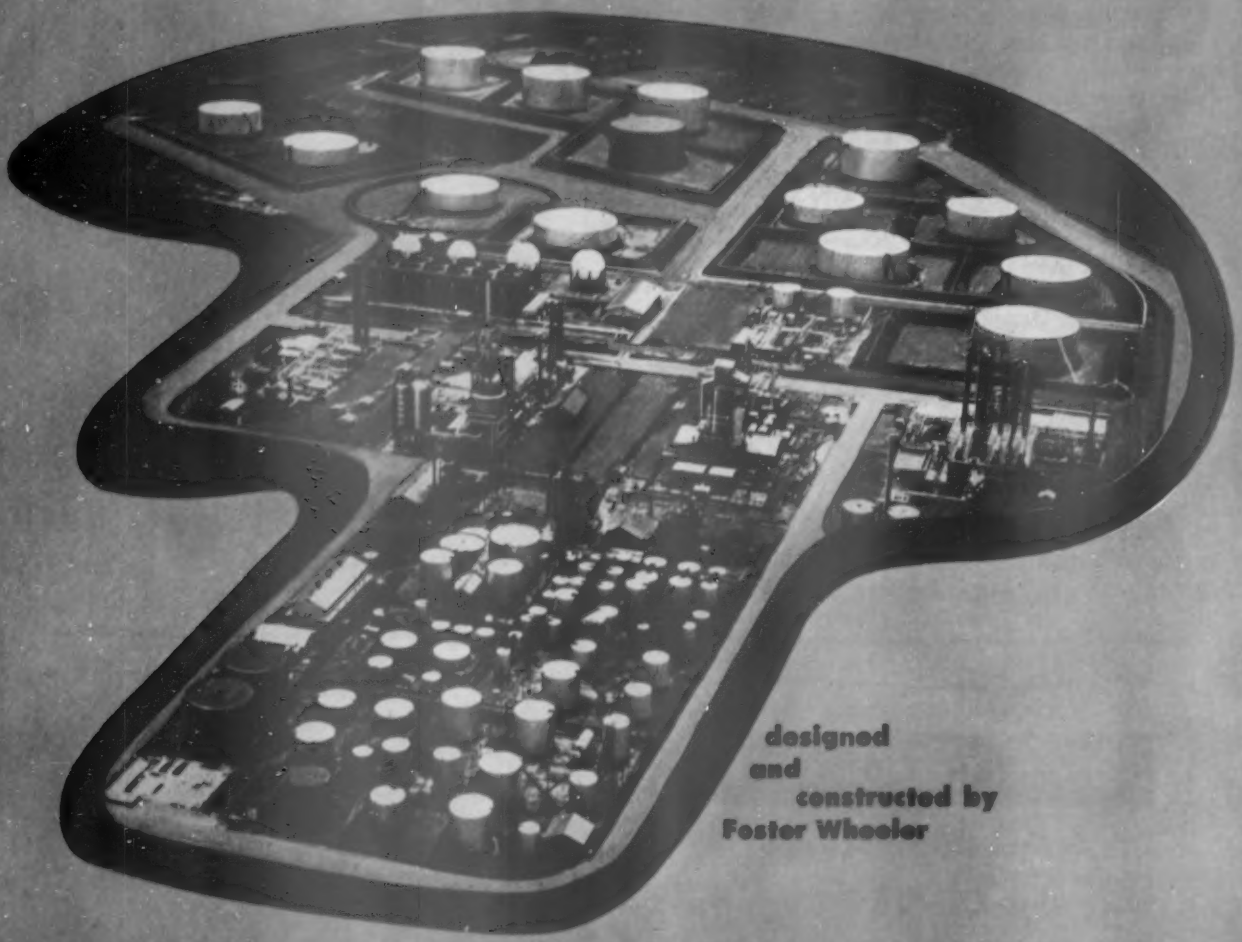

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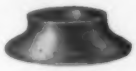

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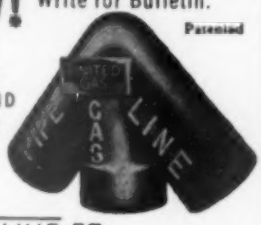

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brication off the top of the cylinder walls, which will result in increased piston-ring and cylinder wear.

As the load on a cylinder or cylinders increases, it finally reaches a point where detonation occurs. At this point, the actual load-carrying capacity of the cylinder decreases. Furthermore, the temperature within the cylinder rises extremely fast and, if the engine continues to run this way, burned pistons and possibly scored cylinders will usually result.

Bearings also affected . . . In addition to the effect that it has on the load-carrying capacity and the detrimental effect that it has on pistons and cylinders, the running of engines with unbalanced power cylinders also has a great deal to do with the life of bearings.

Maintenance and operation . . . The next problem is how to keep the initial pressures balanced. This is primarily a maintenance problem; however, it also requires the cooperation of the individual operators.

The fuel injection valves, ignition system, and scavenging valves must be kept in good condition and ports kept clean in order to make it possible to keep the initial pressures in the cylinders balanced.

Operators must use reasonable judgment in adjusting fuel injection valves when starting up cold engines.

The only sure way to properly balance an engine is by checking the explosion pressure of each individual power cylinder with an explosion indicator and adjusting the clearance on the individual injection valves to increase or decrease the explosion pressures as required to bring the pressures in balance.

On engines equipped with scavenging-air distribution controls, the balancing of the explosion pressures should be done in conjunction with the balancing of the scavenging-air distribution which will in turn balance the exhaust temperatures.

The controls on the scavenging-air system should be locked in position and left alone once they have been properly adjusted. Any adjusting done by the operators should be done to the injection valves only.

Any time that it becomes impossible to obtain an even balance of explosion pressures and exhaust temperatures, it is advisable to check the condition of the injection and scavenging valves, the ignition system, and the intake and exhaust ports.

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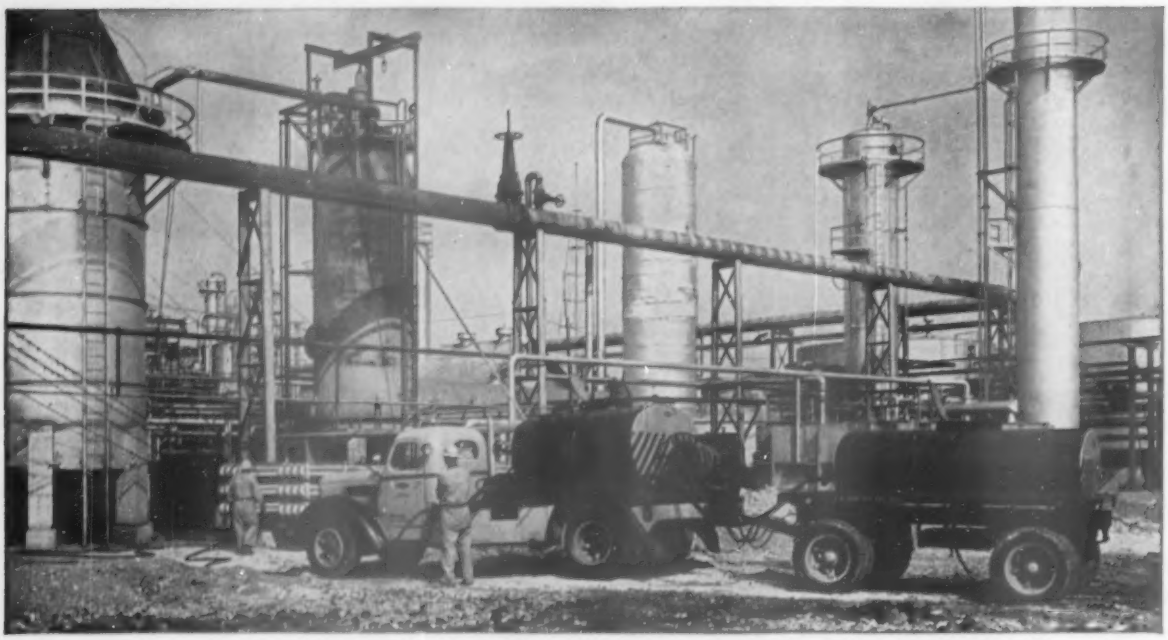
Chemical cleaning restored 200 pounds of pressure lost through scale-choked butane line



A pressure drop of about 200 pounds, due to scale accumulation in a butane line, was increasing pumping costs. The 2½-inch buried line carries butane from a refinery to a butadiene plant five miles away. Dowell Service cleaned the line in 12 hours—*without dismantling or digging*. The results: original discharge pressure was restored . . . the line was metal-clean . . . the workload on equipment handling the butane was lessened, netting the operator a considerable saving.

Dowell engineers took specially prepared solvents in truck-mounted tanks right to the job. They applied the chemicals through regular connections using Dowell-designed equipment, which includes all necessary pumps and control devices.

This is but one example. There are countless others where Dowell provided the practical solution to tricky maintenance cleaning problems. Dowell Service is designed to clean process lines, heat exchangers, tanks and many other pieces of industrial equipment. No special scaffolding is required. Dismantling and downtime are kept to a minimum.

Solvents are applied by Dowell engineers according to the techniques demanded by the job—jetting, filling, spraying, cascading or vaporizing. These liquid chemicals go wherever steam and water flow, reaching surfaces inaccessible to other methods.

You can discuss your cleaning problems fully, simply by calling a Dowell engineer. He will be happy to make cost estimates—no obligation, of course. For more facts about Dowell Service, call your nearest Dowell office. Or, if you prefer, write directly to Tulsa, Dept. J-11.

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REFINING

Contracts Awarded

Expansion of Enid plant started by Chicago Corp.

FORT WORTH.—The Chicago Corp., Fort Worth, has let contracts for construction of a 9,000-bbl. fluid catalytic-cracking unit and a 5,000-bbl. Platformer at the Enid, Okla., refinery of its subsidiary, Champlin Refining Co.

The construction is a part of a $4,000,000 plant-expansion program announced by Chicago shortly after its acquisition of Champlin earlier this year.

Contract for construction of the cracker, a Model B Orthoflow unit, was let to M. W. Kellogg Co. It will go on stream in about a year.

Southwestern Engineering Co. will build the Platformer, which is slated for completion in about 7 months. It will largely replace the refinery's thermal-cracking unit.

The Enid refinery, which has a daily capacity of about 22,000 bbl., is one of two acquired by Chicago Corp., last spring when the company first ventured into the refining and pipeline business. The other refinery is a 1,750-bbl. plant at Oklahoma City, which was acquired from Peppers Refining Co.

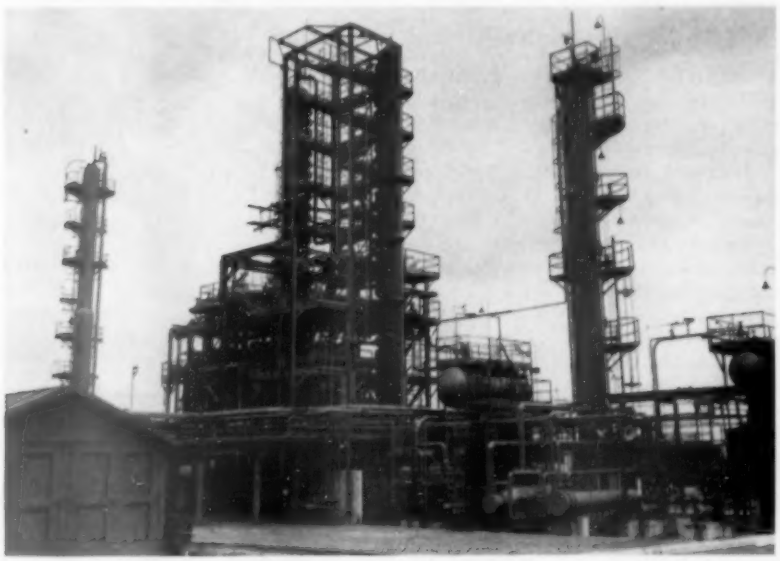
Gulf Closes Refinery

PITTSBURGH.—Gulf Oil Corp. has decided to shutdown its Neville Island, Pa., refinery here because the plant has become an uneconomic operation.

The decision to close the refinery makes the third such comparatively small operation that Gulf has decided to cease this year. Earlier in the year Gulf officials closed the Fort Worth refinery, last week they announced that the Sweetwater, Tex., refinery had been closed for economic reasons.

All three are considered obsolete and depended on the thermal method instead of the catalytic for their cracking. Suggestions that they be modernized were vetoed as too costly for the foreseeable results. At Neville Island, in particular, the available space was not adequate for any expansion.

Gulf's general superintendent in Texas, R. C. Faulkner, said that approximately 40 employes of the Neville



New England's First Local Source of L.P.G. On Stream

New England's first local source of liquefied petroleum gas is this 1,000-bbl. propane recovery unit at Esso Standard Oil Co.'s Everett, Mass., refinery. The new unit will enable Esso to supply part of an area which has had to be served by tank car from the Gulf Coast and the Southwest. The propane recovery unit is part of a $23,000,000 program for modernizing Esso's manufacturing and marketing facilities in New England. The company has also recently completed a 13,500-bbl. asphalt vacuum pipe still and a new Girbotol unit. Standard Oil Development Co. and J. P. O'Donnell, New York engineering firm, collaborated on the engineering for the propane and asphalt plants.

WORKING SCALE MODEL of a Lee C. Moore drilling rig (above) is shown at Tulsa Crating Company where a special crate was designed and engineered to transport it to oil shows and conventions throughout the country. Specializing in Precision Engineered crates and packaging for both domestic and export shipping, Tulsa Crating Company has had over 35 years experience. No item is too big or too small, too delicate or too heavy for the crating specialists at Tulsa Crating Company. One of their departments specializes in the maze of customs regulations that complicate export shipping. No matter what your crating problem is . . . call Tulsa Crating Company, 519 South Rockford, Tulsa, Oklahoma, Phone 3-6482 or 3-3492. (Adv.)

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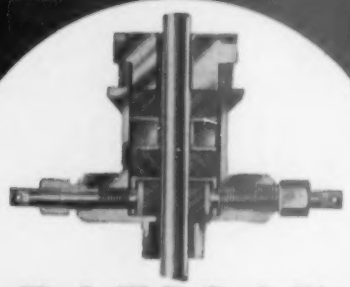

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Island refinery would be transferred to the Port Arthur refinery.

Bay To Build Reformer

DENVER. — Bay Petroleum Corp. has announced plans to build a 1,500-bbl. catalytic reforming unit at its 18,000-bbl. per day refinery at Chalmette, La., refinery.

The company recently was granted a certificate of necessity for more than $1,000,000, covering the cost of the reformer and the expense incurred in moving a topping and cracking still from the company's refinery at McPherson, Kans., which was shut down recently.

Stanotex To Add Platformer

EL PASO.—Standard Oil Co. of Texas will build a 4,300-bbl. Platforming unit at its refinery here.

The company has not contracted for the construction of the Universal Oil Products-licensed reformer, but it has said that it expects to have the unit on stream by the middle of 1955.

The company's refinery capacity here is 30,000 bbl. daily although at present it is running only 26,000 bbl. The Platformer will be used to upgrade the gasoline output and no increase in capacity is contemplated now.

Panhandle Completes Units

WICHITA FALLS, Tex.—Panhandle Oil Corp. has recently completed a modernization program at its 8,000-bbl. refinery here.

The work included a 2,400-bbl. per day stabilizing unit for straight-run gasoline, a revamping of the catalytic polymerization feed treating equipment, new facilities for the treating, storage, and transport loading of propane-butane mixtures, and a new 6,000-bbl. sphere for natural-gasoline storage. The work was done by Tears Engineers of Dallas.

New Safety Mark

SAN FRANCISCO. — Tide Water Associated Oil Co. employes at the Avon, California refinery have just passed the two and one-half million man-hour mark without a single disabling injury.

The 1,450 men and women at Avon previously exceeded the million man-hour mark without a lost time injury, but the present record representing 318 days surpasses any other mark at the 100,000-bbl. per day refinery.

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PROVIDES interior air pressure 15 psi greater than surrounding gas atmospheres and prevents entrance of any gas, paint vapors, dusts, etc. Air pressure is self-contained and lasts life of lamp.

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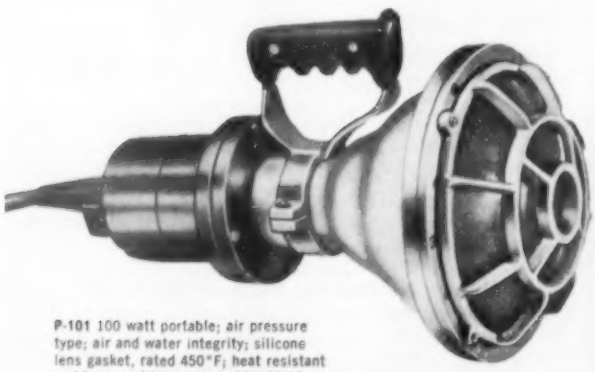

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fig. 1501—This popular OS&Y flanged end gate valve has a primary rating of 150 psi at 500° F. It is furnished in sizes from 1½" to 24". Construction features that lengthen valve life, lower maintenance requirements, include:

wedge and wedge guides—Solid I-beam type wedge for maximum resistance to distortion. Wedge guides, cast to true center of seating surfaces, guide wedge to a perfect seat—make contact only at point of closure.

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for further information on Fig. 1501 or other R-P&C cast steel valves, write for Catalog 9

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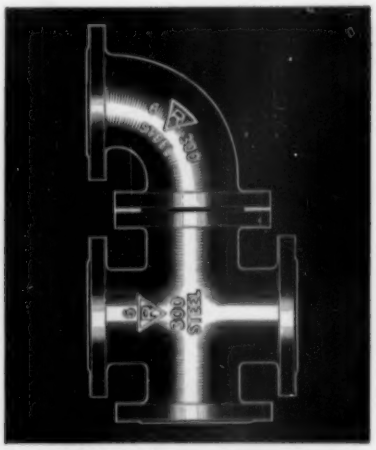

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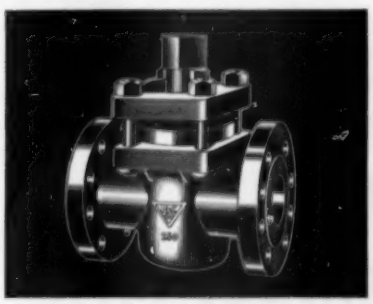
This hidden ingredient is called "quality control." It is a philosophy that dominates every step of the manufacturing operations that produce each R-P&C Valve.

Castings for every R-P&C Valve are produced in our own foundries under careful metallurgical controls. Casting soundness is verified by special radiographic techniques using radium or radioactive isotopes. Dimensional accuracy of each valve part is checked by a variety of gauging methods, including some specially developed by R-P&C engineers.

Before it leaves the factory, the performance of each valve is proved by individual hydrostatic and other tests. These tests are normally conducted at pressures higher than those for which the valves are rated.



Asbestos-packed cocks, an R-P&C exclusive, are furnished in iron in sizes from ¼" to 6" with screwed or flanged ends.

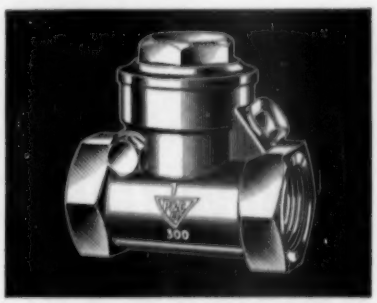


Fig. 212 screwed end bronze check valve typifies R-P&C's complete check valve line — furnished in iron, bronze or cast steel in sizes ranging from ¼" to 24".

WHICH OF THESE HELPFUL TECHNICAL AIDS DO YOU WANT?

R-P&C provides a wide variety of free technical aids to assist the buyer in valve selection, installation and operation. Among these are:

Valve Selector Slide Rule. Handy selector slide rule gives all dimensions for iron body valves, steel valves in 150, 300, 400, 600, 900 and 1500 lb. classes.

How To Select Valves. 17" by 11" wall chart lists principles to use in selecting valves for various applications . . . considers effects of fluids, temperatures, pressures, sizes, service requirements.

How To Protect Your Valves. 17" by 11" wall chart lists 22 installation and operation pointers to protect valves, get maximum life.

How To Know Valves. 17" x 11" wall chart graphically illustrates appearance, construction, operation, recommended applications for gate, globe and check valves, cocks.

Any of these free technical aids furnished promptly on request
Write R-P&C Valve Division, American Chain & Cable, Reading, Pennsylvania

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R-P&C valves

more hole per hose
more use per dollar

in NEW IMPROVED
RAY-MAN CBL ROTARY HOSE

Valuable features give you "More Use per Dollar" in the new, improved Ray-Man CBL Rotary Hose. First is the special cable wire construction that permits more flexibility with a higher safety factor. It has higher resistance to accidental crushing. Easier to handle properly in transport and make-up on the rig. Streamlined, built-in coupling with blow-out proof "Lip-Lok" Seal tightens under high pressure. This safety feature alone justifies your investment in Ray-Man CBL, but its many other features make it easily the lowest cost rotary hose in footage drilled.

DISTRIBUTED BY NATIONAL SUPPLY COMPANY IN ALL PRINCIPAL OIL FIELDS

For information on other R/M rubber products; oil-loading, LPG and other hose, transmission, and V-belts, molded products, write for Catalog 6903.

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MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Other R/M products include: Industrial Rubber • Fan Belts • Radiator Hose • Brake Linings • Brake Blocks • Clutch Facings
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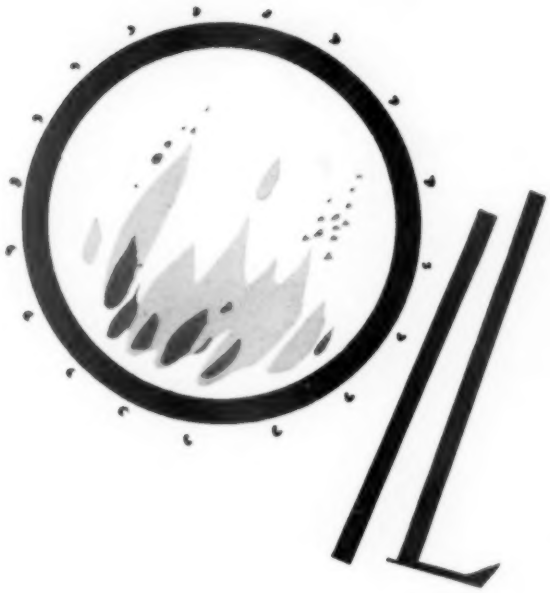

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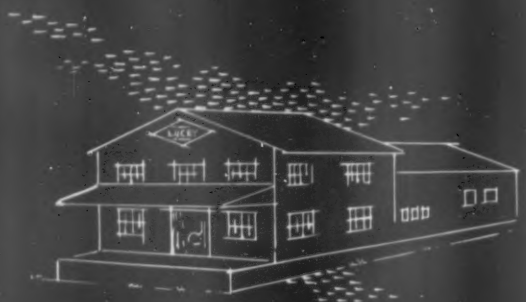

The Lucey Diamond symbolizes an organization that is versatile and aggressive, known especially for its ability to perform unusual services tailored to specific situations.

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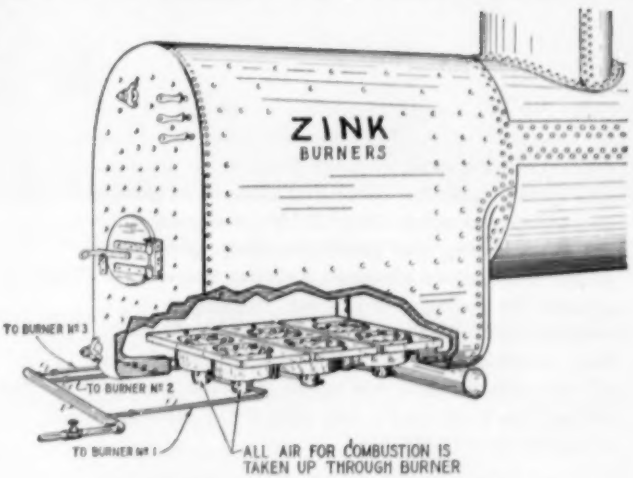
The best known burner in the oil industry—John Zink Burners fire most of the stationary oil field boilers in gasoline plants.

The VBM Short Flame Gas Burner operates on the fuel available—refinery gas, natural gas, oil vapors or a mixture of gases.

Being all in one piece and sturdily constructed, the VBM is easily installed in either wet bottom or dry bottom locomotive type boilers, without alterations.

The VBM can be used with *high or low pressure* gas . It is not damaged or performance impaired when slugs of water, oil or gasoline blows through or spills down over them.



BI-MIX BURNERS are available for Vertical or Horizontal firing and for burning any kind of gas—natural, mixed, refinery and gases of *high hydrogen* content.

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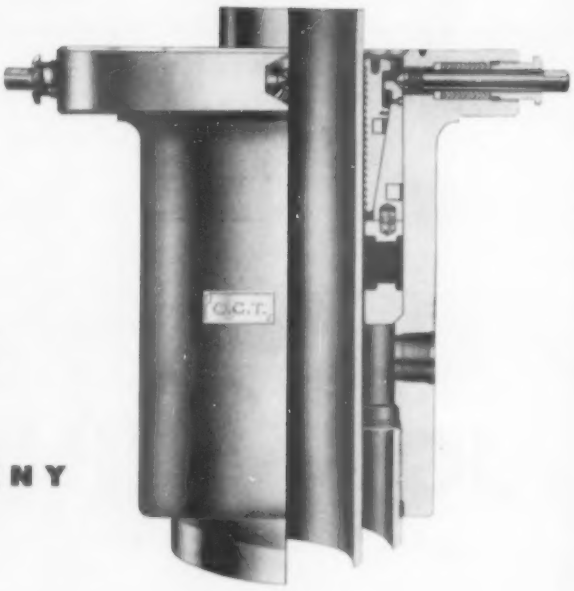
O-C-T "C-19" Casing Heads are a natural for off-shore work. They are designed for maximum safety on both land and off-shore wells, saving you added costs for special equipment to give you the protection you need. The "C-19", designed for quick setting and positive sealing, gives extra protection against blowouts because the well is closed in around the casing and the seal applied automatically before preventers are unflanged. Both crews and rig are protected. Enough hours of valuable rig time are saved to more than pay for the cost of the head itself. Ask your O-C-T representative or write for information.



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Export Representatives: Sterling Areas — Le Grand, Sutcliff & Gell, Ltd., Rochester, Kent, England. Address Export Inquiries for All Other Countries to P. O. Box 3091, Houston, Texas.

Illustration at bottom shows effect of high-velocity turbulently flowing sea water on the inlet end of an Admiralty tube. At the top you see the effect of high-velocity, turbulent flow of sea water around once-lodged pebble or shell in Admiralty tube cooled by sea water.

VELOCITY: how serious tube damage from this cause can be avoided

High velocity is a big factor in causing turbulent flow of the cooling water. This in turn may lead to rapid inlet-end corrosion of condenser tubes, particularly in plants on tide water. You can smooth out the flow of water by using deep water boxes and by flaring the inlet ends of tubes. And you should do away with water obstructions. All these help to increase tube life.

Where a tube is partially blocked by a pebble, shell or other debris, local high velocities can occur. It is highly desirable to prevent the entrance of such material into condenser tubes. But it's not always possible. If you want to avoid serious damage from this cause, inspect and clean tubes frequently.

Velocity is only one factor affecting tube life. Publication B-2, "Anaconda Tubes and Plates for Condensers and Heat Exchangers," discusses *all* the important operational factors, and gives much other useful information. And, of course, our Technical Department stands ready to assist you in the selection of tube alloys from our extensive line. *The American Brass Co., Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.*

4416

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Tubes and Plates for

Condensers and Heat Exchangers

Arsenical Admiralty-439; Ambraloy-927; Cupro Nickel, 30%-702; and other copper alloys*

*U. S. Patent No. 2,005,682 (ORIG.)

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DROP FORGED STEEL

VALVES, FITTINGS and FLANGES

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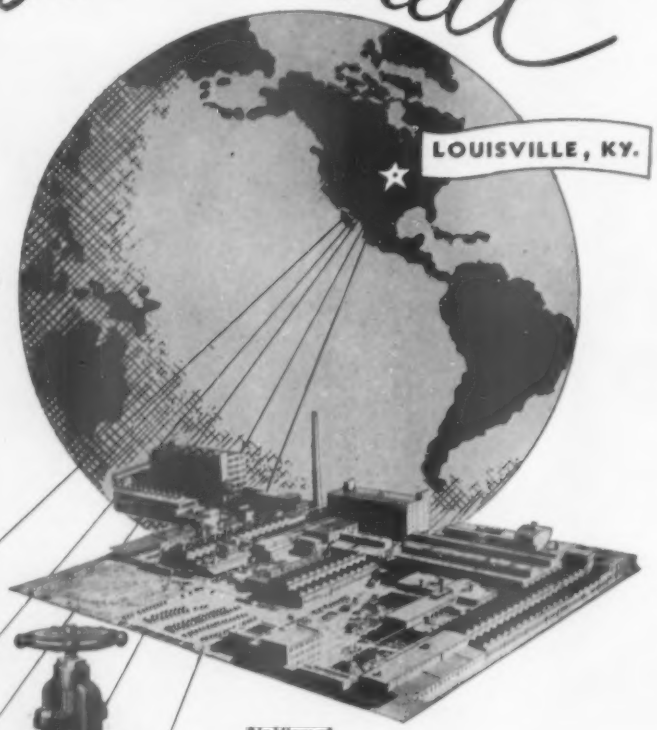

Air View of
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This 24 acre Vogt plant supplies the most comprehensive line of top quality *drop forged* steel piping materials anywhere available to industry. That's why they're the choice of leading refineries, power plants, chemical plants, etc., the world around!

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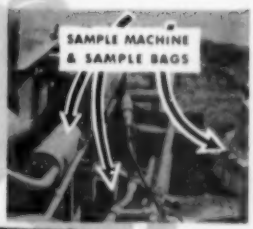
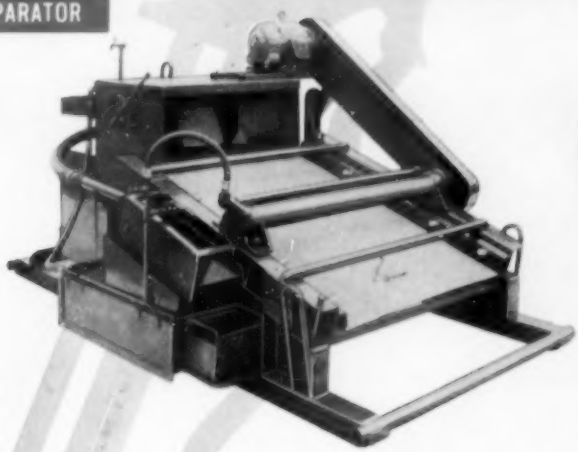


ROTATING SHALE SEPARATOR



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Either one of the above machines will offer the drilling contractor bigger savings in drilling time and drilling costs. The Thompson Shale Separator and Shale Shaker are outstanding for ECONOMICAL OPERATION and for PROVEN PERFORMANCE. They do an excellent job of removing destructive shale and abrasives from mud and Thompson's famous SAMPLE MACHINE (Standard Equipment) gives you more information about drilling formations through highly accurate samples. For more complete information — WRITE THOMPSON — TODAY!

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IOWA PARK, TEXAS

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2 **FACILITIES** that are large and modern in every way, giving our customers unexcelled service to meet their needs.

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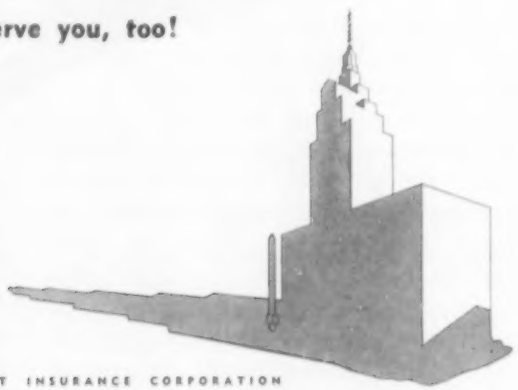
4 **SERVICE** that is prompt and complete, assuring our customers the best when they do business with us.

5 **COOPERATION** based on full understanding of the oil man's problems and opportunities.

We would like to serve you, too!



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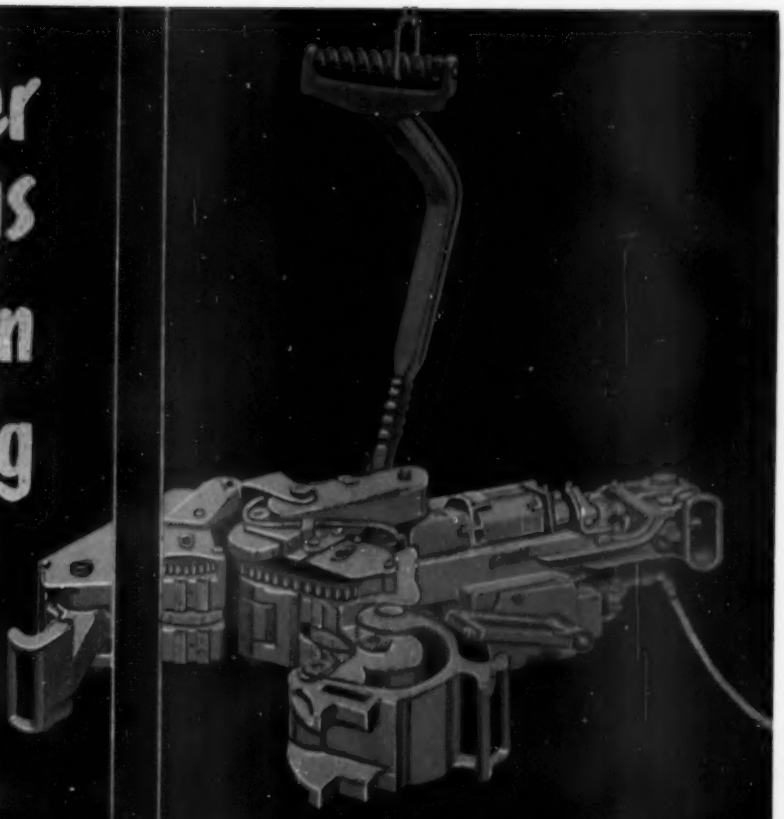
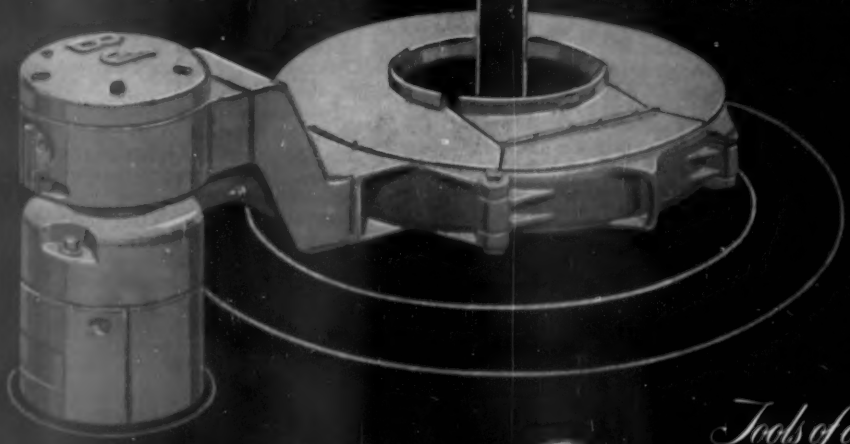


POWER TONG

BJ

POWER SLIPS



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Vehicles that haul 75 ton loads... Shovels that handle 16 yards and more at a single bite... these are but two of the many juggernauts that move mountains or mole hills... that give industry *higher production at lower cost.* And the key to velvet-smooth control of all this harnessed energy is Fluid Power!

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There are three divisions of The New York Air Brake Company which concentrate on the development of advanced design hydraulic equipment for this Fluid Power. Thus, from a single source, industry may have the ideal component for the specific function. . . . Gear, Dual-Vane and Piston Pumps, embracing a full range of capacities and pressures to 5000 psi, and Motors, Control Valves and Cylinders to develop complete hydraulic circuits.

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Write today for literature containing hundreds of ideas for you to improve your product, increase production and lower costs.

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Over the highways, the by-ways and the rail systems of the great Mid-Continent area, "ANOTHER LOAD OF LONE STAR PIPE" is a familiar sign. More than that, it is mute evidence that Lone Star's mammoth mill is daily turning out thousands of feet of high quality electric weld steel pipe for the petroleum industry. Mixed in with this production is a generous flow of cast iron pressure pipe destined to the progressive municipalities of the Southwest.

Yes, things are humming at Lone Star. Employment is high, production is ever-increasing. Business is good because actual field experience has proved to hundreds of satisfied customers that you just can't buy a better pipe anywhere. Added to quality—attested to by the appearance of the API monogram on Lone Star steel tubular goods, and the Underwriters' Laboratories stamp of approval on cast iron pipe—is another advantage found only in Lone Star pipe: It is manufactured in the heart of the Mid-Continent area where the bulk of the nation's petroleum products are produced, in most cases, no more than an overnight haul from mill to destination.

Make your next order "ANOTHER LOAD OF LONE STAR PIPE."

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Every pound *helps haul itself* on these advanced FWD trucks. That's because it's "working weight." Improved Math-Matic Design—*exclusive* on FWD's—correctly proportions power to weight on front and rear axles. Each wheel's load makes it *grip harder*, using every ounce of power for greater controllable traction *on* or *off* the road.

From 30 to 37% longer tire life* . . . up to 82% more tractive ability* . . . safest by far to operate under *any* driving conditions* . . . all these extra values without extra fuel consumption—here are dollar and *sense* reasons why *you* should get full facts immediately on this greatly advanced line of heavy-duty trucks. Four-wheel-drive and six-wheel-drive models for any "truck-killing" job

- ★ **Greater power-weight ratio, higher RPM, thru new engine design!**
- ★ **Lower maintenance costs because of standardized parts!**
- ★ **Larger legal payload thru better weight distribution!**
- ★ **New comfort—convenience—safety in completely redesigned cab!**

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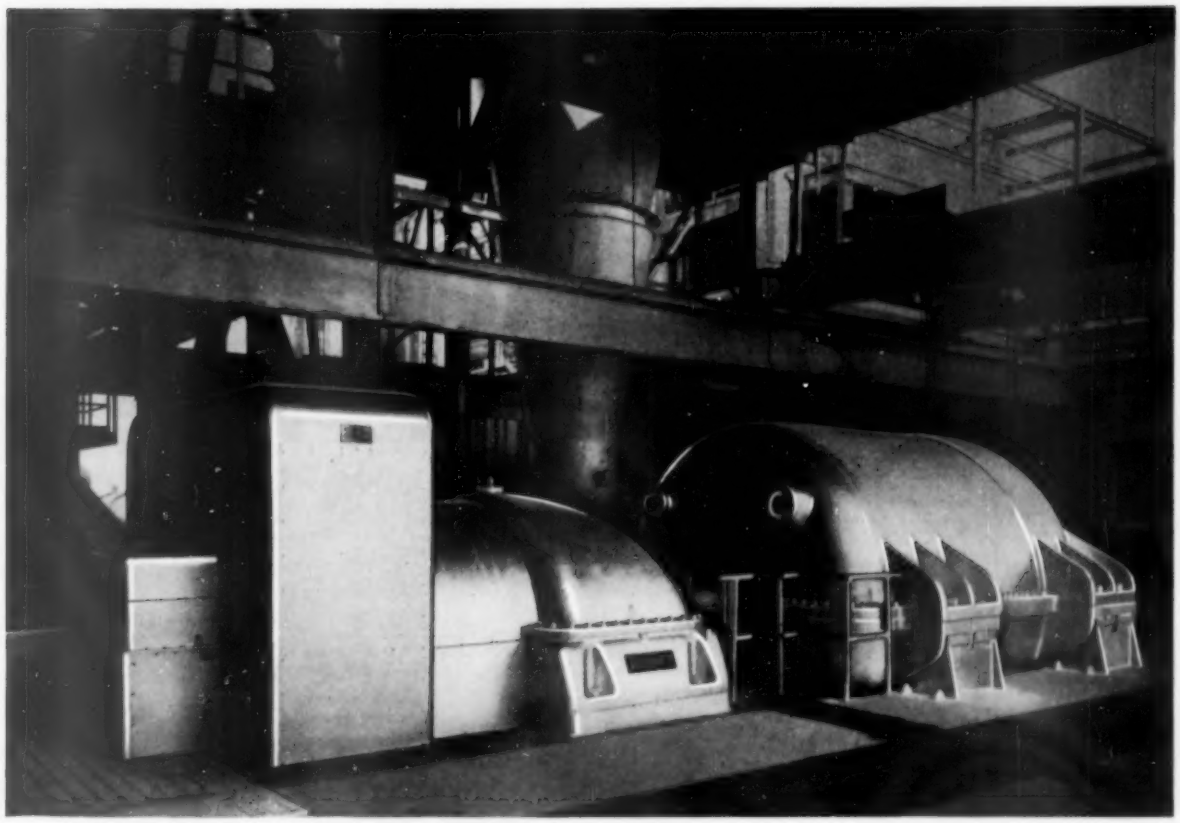
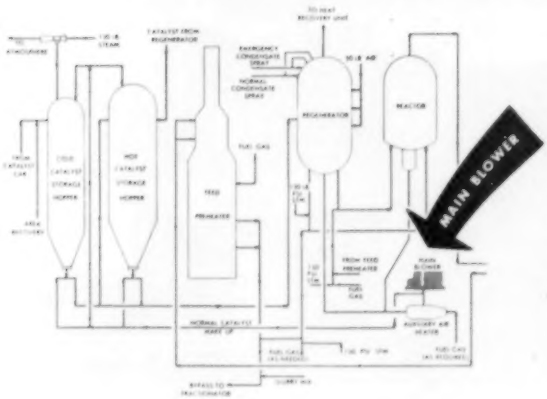
BUILDERS OF AMERICA'S FOREMOST HEAVY-DUTY TRUCKS

THE FOUR WHEEL DRIVE AUTO COMPANY, CLINTONVILLE, WISCONSIN, *Canadian Factory,* KITCHENER, ONTARIO



Largest Centrifugal Compressor for fluid "CAT CRACKER" Service



has now been operating about a year in the Sinclair Refining Company's new refinery unit at Houston, Texas. The compressor handles 135,500 inlet cfm of air at 22.0 psig discharge pressure; the turbine develops 12,440 horsepower at 2400 rpm. Complete unit emphasizes ruggedness and accessibility, assuring reliable "non-stop" performance over long periods of time.

Large or small, Elliott can furnish your centrifugal compressor requirements and assure you of equally satisfactory performance. Elliott centrifugal air and gas compressors are serving the petroleum industry throughout the world. Consult your local Elliott office for details or write Elliott Company, Centrifugal Compressor Department, Jeannette, Pa.

ELLIOTT Company

P4-4

TURBINE-GENERATORS TURBINES MOTORS GENERATORS DEAERATING HEATERS EJECTORS CONDENSERS COMPRESSORS TURBOCHARGERS TUBE CLEANERS STRAINERS

IF IT'S POWER YOU WANT.... Specify

the WILSON-SNYDER NO. 220-P SLUSH PUMP

Here is a Power Slush Pump built for the heavy duty work that present drilling demands. It has greater capacity and greater horsepower.

Naturally it is larger and more powerful.

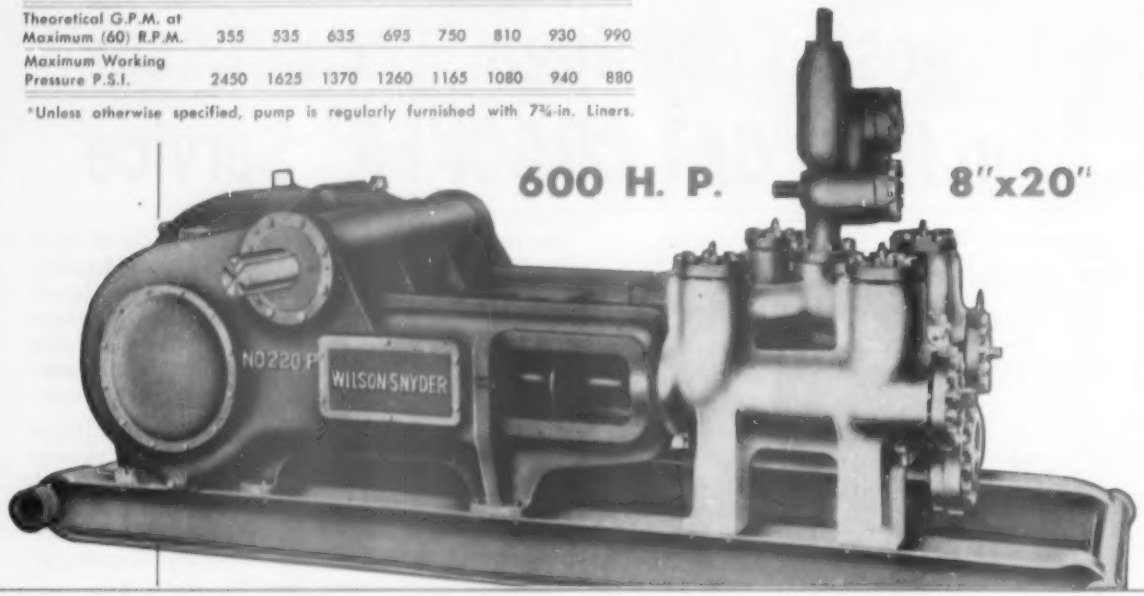
Some of the many Wilson-Snyder features found in the No. 220-P are: (1) single helical gears with shafts set in adjustable tapered roller bearings, (2) oil bath lubrication, (3) grease lubricated crosshead pin bearings, permitting lubrication without shutting down, (4) special arrangements of the diaphragm packing and the mud baffle, (5) deep stuffing boxes, designed for rod lubrication, (6) Di-Hard Liners with Tell-Tale Liner Packing and Heavy Duty Liner Spacers with outside adjustment, (7) Heavy Duty Fluid Valves.

Displacement (Rod Deducted) and Pressure Range

Available Liner Sizes	5-in	6-in	6½-in	6¾-in	7-in	7¼-in	7¾-in	*8-in
Theoretical G.P.M. at Maximum (60) R.P.M.	355	535	635	695	750	810	930	990
Maximum Working Pressure P.S.I.	2450	1625	1370	1260	1165	1080	940	880

*Unless otherwise specified, pump is regularly furnished with 7¾-in. Liners.

600 H. P. **8"x20"**



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SALES OFFICES:
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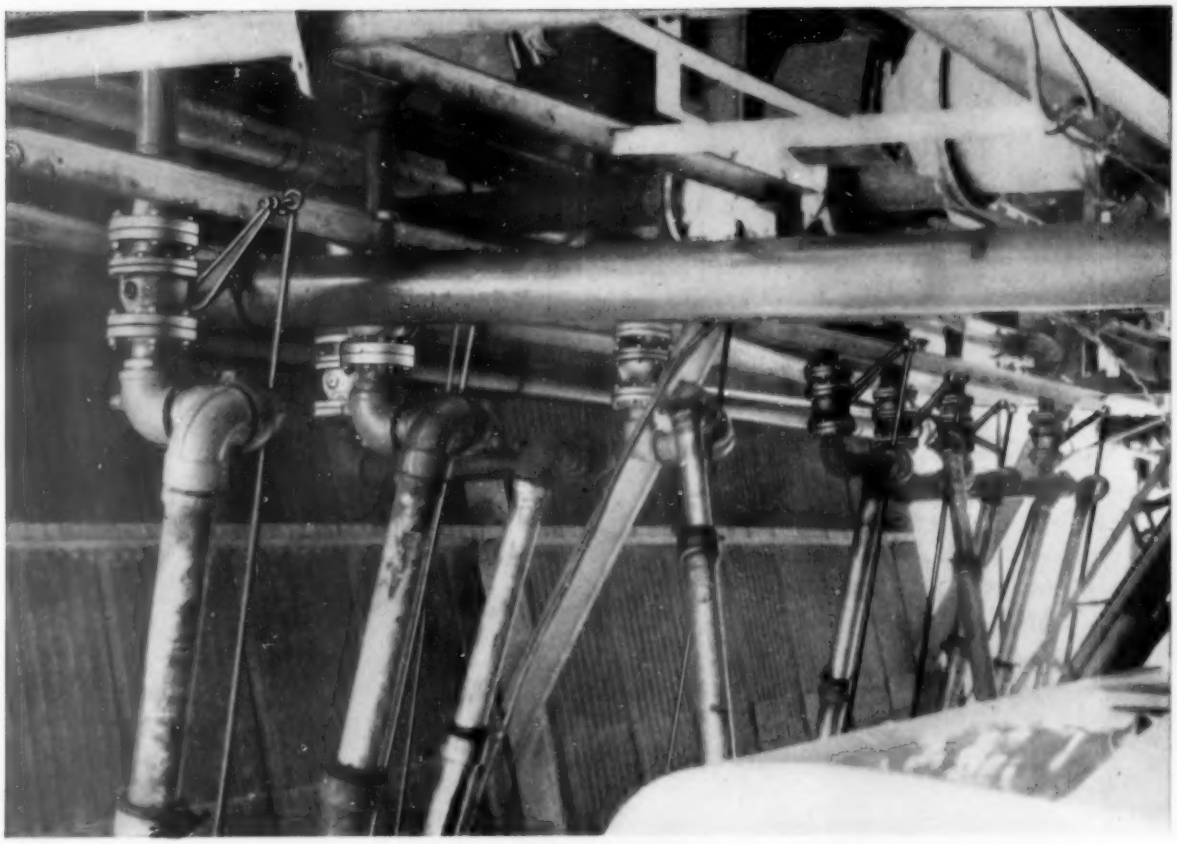

Busiest loading rack in the Midwest relies on Rockwood Ball Valves

Day in, day out, twenty-four hours a day, the fuel loading rack above fills tank trucks — in record time.

Eight Rockwood Ball Valves perform this grueling operation, opening and closing in trigger time — permitting a full, round flow of fuel — and preventing dangerous oil sludge on the loading pavement by remaining absolutely leak-proof.

What makes Rockwood Ball Valves so outstanding? These four exclusive features assure trouble-free efficiency:

Full Round Flow — no change in shape or volume of fluid stream — no turbulence — no minimum loss.

Quick Opening and Closing — only a quarter turn needed, even under full pressure.

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If you are not now using Rockwood Ball Valves, send coupon today for complete information. Valves come in all pipe sizes. Tested and listed by Underwriters' Laboratories, Inc.

ROCKWOOD BALL VALVES

FULL, ROUND FLOW

ROCKWOOD SPRINKLER COMPANY
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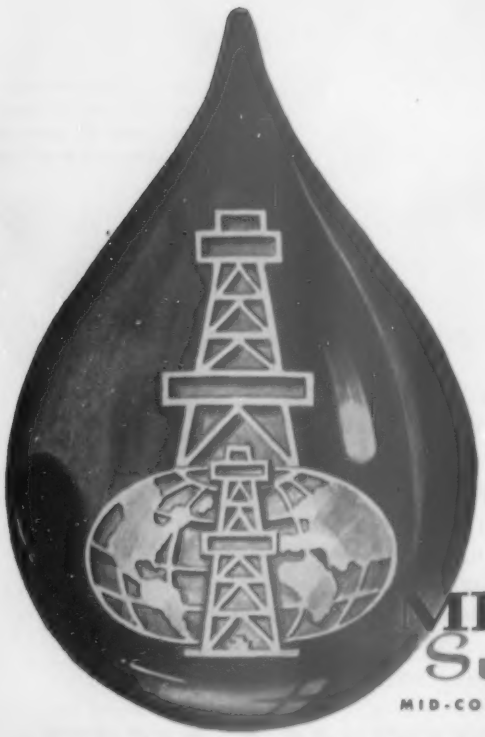

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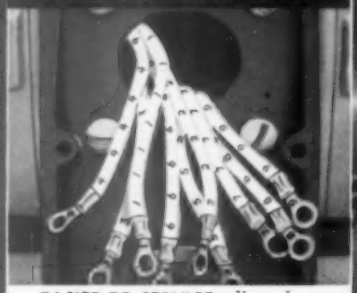

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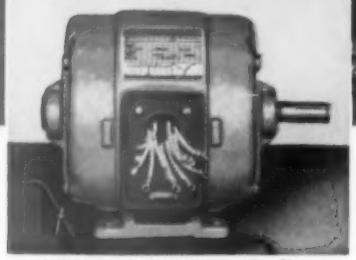

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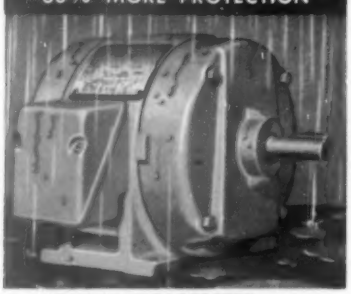

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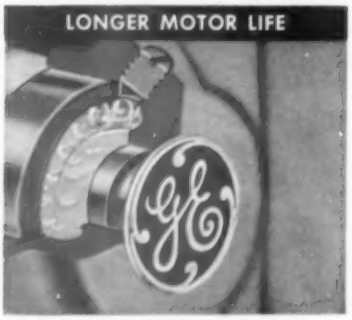

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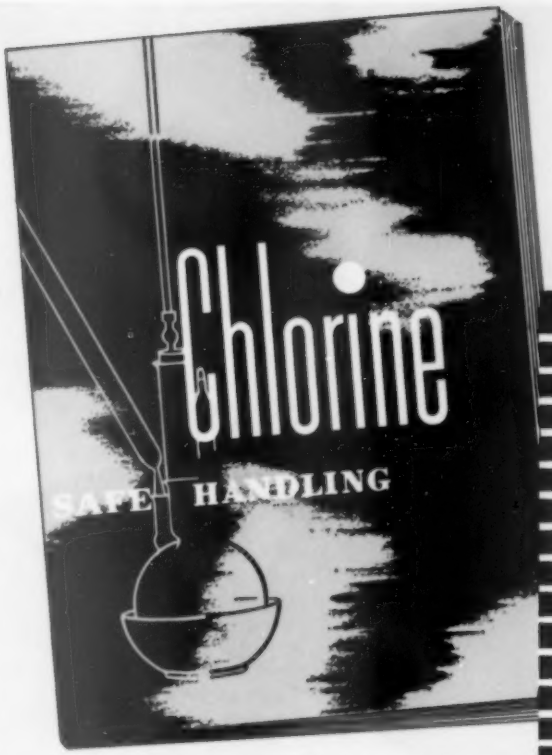

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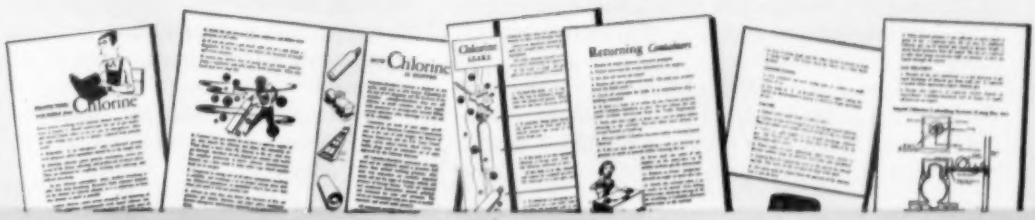

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Pumping Costs Are High When They're Deep

. . . so it's smart to study cost-reduction methods

by Barney O. Carlson

A growing problem for producing companies is how to recover the maximum amount of oil from deep reservoirs with a minimum of cost. Many of the deep fields will require deep artificial lift; and the installation and operation of any method of deep pumping is costly. Consequently, oil operators must make every effort to reduce costs in order to obtain reasonable profits from deep-pumping wells.

The artificial lift of fluid from deep depths does not differ greatly in principle from that of pumping relatively shallow wells. Problems caused by corrosion, abrasion, or normal wear can exist in any lift installation; however, the problems inherent with any method of pumping are usually amplified with depth. A particular problem might be four times as troublesome with a 10,000-ft. lift as it is with a 5,000-ft. lift. Since there is only a small margin for error, it is essential that close control be exercised with deep-lift installations. The percentage of total pumping wells which require deep lifts is relatively small, but the number will increase and even deeper pumping will be required in the future.

What is deep pumping? . . . To discuss the problems encountered in artificially lifting fluid from oil producers which have deep working fluid levels, a deep-pumping well shall be considered to have fluid lift from 7,000 ft. or deeper. This classification does not include all **deep wells** since many are in reservoirs with active water drives which will not require fluid lifts from depths as great as 7,000 ft.

It is estimated that 10 per cent or more of the wells currently requiring artificial lift in the West Texas-New Mexico area of production are deep pumpers or will be prior to depletion. Also, with the deeper drilling which is now in progress, it is only logical to assume that the number of deep pumpers will increase.

Three methods available . . . There are three methods commonly used to lift production from deep pumping wells. These are rod pumping, hydraulic pumping, and gas lift. Rod pumping is the most widely employed method of artificial lift, and the development of long-stroke pumping units and high-strength sucker rods has made practical the lift of deep wells with rod equipment. Hydraulic pumping has been used for deep fluid lifts for several years.

Gas lift is an old production method which is in general use for shallow, high-rate lifts, and during recent years

Author is with Shell Oil Co., Hobbs, N. Mex. Paper presented at 1954 Texas Tech Oil-Lifting-Methods Short Course, Lubbock.

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▶ No other product has proved so successful for so many applications as the BAKER RETAINER PRODUCTION PACKER, which can be set on tubing, drill pipe, or on a wire line. Look on Page 496 of the 1954 Composite Catalog to learn how it is used for single-zone or dual-zone production; as a squeeze tool for acidizing or cementing; as a tubing anchor and as a bridge plug.

▶ For placing cement slurry, plastic, acid or other fluids, the BAKER RETRIEVABLE CEMENTER provides a safe, positive "Hold-Down Type" Packer which operates mechanically rather than by fluid pressure. Look on Page 495 of the 1954 Composite Catalog.

▶ BAKER CASING BRIDGE PLUGS can be set on tubing, drill pipe, or on a wire line to provide either a permanent or a temporary bridge plug which prevents either upward or downward movement of fluid or gas. Many other advantages are described starting on Page 474 of the 1954 Composite Catalog.

▶ No other product can equal the efficiency of the BAKER CEMENT WASH-DOWN WHIRLER FLOAT SHOE for safely floating-in and landing casing strings of any length. Removes bridges, washes the formation, and imparts a "whirling" action to the slurry. See Page 438 of the 1954 Composite Catalog.

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▶ BAKER FLEXIFLOW FILL-UP SHOES (or Collars) permit filling the casing automatically as it is being run, while maintaining a relatively constant level of dry (unfilled) casing until the casing has been landed. It is then possible to bring the Bakelite Ball Valve into play as a back-pressure valve for floating and/or cementing when desired. This latest Baker development is illustrated and described in a folder available upon request from any Baker office.

▶ For successfully placing cement or fluid at the place where it will be most effective, the BAKER CEMENT RETAINER has been "standard equipment" in International oil fields for many years. Read of its many uses starting on Page 474 of the 1954 Composite Catalog.

▶ The importance of having the I.D. of casing free from gun-shot burrs, hardened rotary mud and mill scale is evident from the rapidly increasing use of BAKER ROTO-VERT CASING SCRAPERS. Can be run easily and safely on drill pipe, tubing or a wire line, and leaves the "working surface" of casing clean and smooth for all future operations. Look on Page 517 of the 1954 Composite Catalog for details.

▶ When the time comes to center casing *positively*, and provide a uniform annular space for successful cementing, you need BAKER HINGE-LOK CASING CENTRALIZERS. Made in four ranges to exactly meet your casing programs, with many features not found in other centralizers. Interesting facts and illustrations start on Page 462 of the 1954 Composite (or Baker) Catalog.

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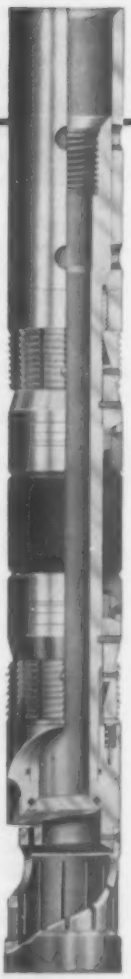
▶ Any drilling man will tell you how the BAKER DRILL PIPE FLOAT VALVE lengthens the life of wire lines and brake bands by relieving weight; how it prevents pulling "wet" strings; how it prevents or minimizes accidents in case the drilling string should part. See for yourself on Page 534 of the 1954 Composite Catalog.



Baker Retainer Production Packer
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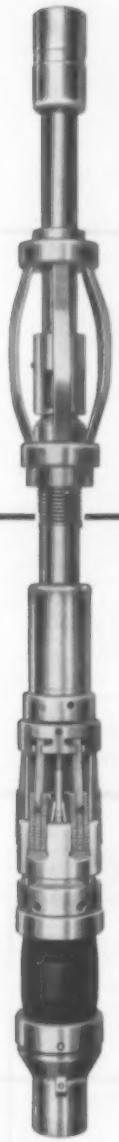

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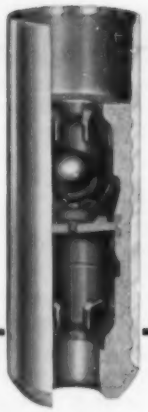

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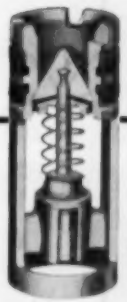

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The Baker Section starts on Page 435 of your 1954 Composite Catalog; or if you prefer a separate BAKER Catalog, contact the office nearest you.

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there have been applications of this method to deep-well artificial lift.

The power transmitting medium is different for each of the several lift methods. Sucker rods transmit energy to a bottom-hole pump with rod pumping, and lease oil under pressure is the power-transmitting medium with a hydraulic system. Gas lift utilizes the energy released from compressed gas. The over-all efficiency of any of the lift methods is low. Practical experience indicates that the mechanical or positive-displacement methods, rod and hydraulic pumping, have efficiencies which are generally higher than those experienced with gas lift. Over-all efficiencies must be considered in selecting prime-mover horsepower, but it should be stressed that the over-all lift efficiency is not necessarily directly proportional to lifting costs.

There are no set standards or policies within the industry concerning application of lift methods. It is generally true, however, that there are some pumping conditions, surface and subsurface, which makes one particular method of lift the most attractive. There is a constant search for better methods or improvements in equipment or operation of present methods. That a best lift method for deep wells has not been found is evidenced by current selection practices. In one relatively small field in New Mexico the three lift methods being discussed have been installed to lift production from the same reservoir. From this observation it might be concluded that operators have much to learn about deep-well pumping since it is improbable that the three methods will give the same results.

How to select method . . . The selection of equipment to lift production from deep wells efficiently is a problem that is becoming increasingly important as it becomes necessary to deplete by artificial lift a larger number of deep reservoirs. Therefore, the first problem encountered in deep-well pumping is the selection of a pumping method which will give the desired lift with the lowest capital expenditure and operating expense.

Some of the factors which are considered in selecting a deep-well pumping method are past artificial-lift experience, new developments, surface and subsurface conditions, and past predicted well performance. Information from field personnel regarding the deep well can be of great assistance in this study. Well-producing characteristics and test production data should be accurately reported. Swabbing tests are not an absolute indication of a well's productive capacity, but they are repre-

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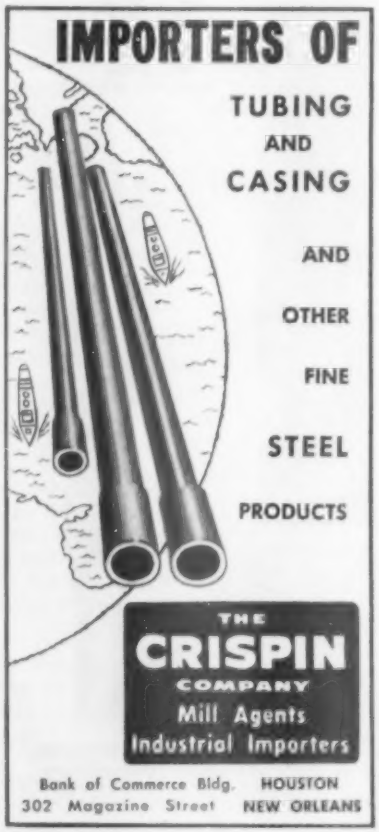
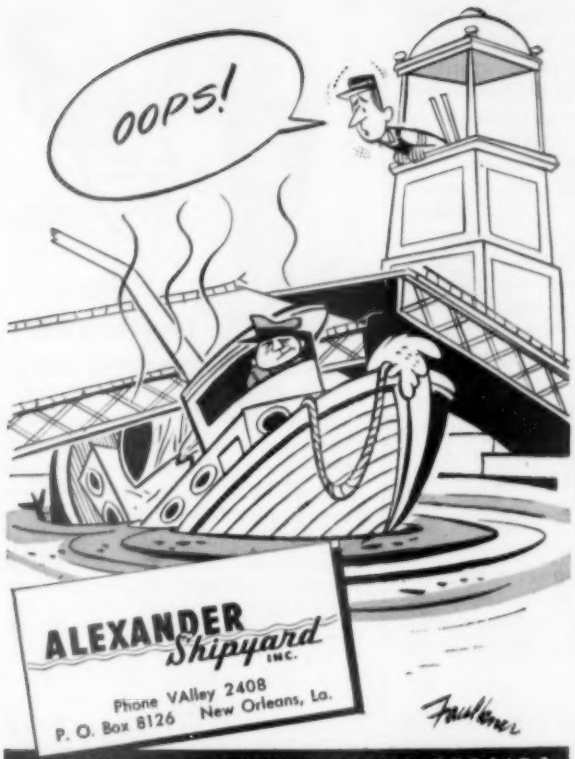
E. E. (Gene) Buchner





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sentative, and such information as swabbing rate, water cut, working fluid level, or drawdown should be reported.

In the case of a test pumping installation, all pertinent well-production data should be precisely reported since considerable money is expended to get representative test pumping data. The important consideration is that an engineer needs more information than the bare fact that a well needs pumping to select the most economical deep-lift method. With accurate test data and the basic reservoir and well data which are available, it will be possible to study the problem and make a sound recommendation.

After a lift method has been selected, the engineer must design a particular installation from the available equipment. A factor which must be considered in the final equipment selection is the experience and ability of field personnel since it is the production foreman and pumper who must operate a system or installation. It is usually economical to install equipment which will require a minimum of pumper attendance.

General problems . . . There are a few general problems which must be overcome to gain desired results with any of the lift methods. Probably the most important of these is to get field personnel completely familiar with the method and equipment in use. The pumper must know how to operate, maintain, and regulate the installation properly. It is he who must utilize the equipment to lift oil from a well, and it is he who can get the most from the installation. There should be no questions unanswered as to routine operation and maintenance. The pumper should also be capable of analyzing operational difficulties, and he should know equipment limitations.

Lifting rate control . . . Another problem which enters into the operation of any pumping equipment is pumping rate. It is desirable that the rate of equipment operation be within safe limits and that the lift rate be within the well's productive capacity with any artificial-lift installation, but these factors are of special importance for deep-well pumping. When rate of displacement with positive displacement equipment exceeds the rate of well production, an overpumped condition of fluid pound and low volumetric efficiency results. Overpumping adds excessive wear to rod or hydraulic pumping equipment and will increase lifting costs for any of the methods. A severe fluid pound will part a string of highly stressed sucker rods and will reduce the

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Peerless Pump Division, Food Machinery and Chemical Corporation, Los Angeles, manufactures an entire line of centrifugal pumps. Before changing to LATTICE BRAID, Peerless regularly received frequent complaints on packing from their customers. Now that Peerless has *standardized* on LATTICE BRAID, complaints are rare. In addition, Peerless reports that LATTICE BRAID *resists* the excessive gland pressure often applied by uninformed repairmen. The result is that there is *less* packing and sleeve wear.

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GARLOCK LATTICE BRAID PACKING

useful life of a bottom-hole production unit or pump.

The injection of more gas than needed in a gas-lift well increases lifting costs, and in some cases there may be a decrease in production. The importance of correcting the costly practice of operating with a fluid pound and low volumetric efficiency cannot be overemphasized.

Management sometimes unknowingly is responsible for an overpumped condition because of the emphasis given to getting maximum production from any well. With deep-well pumping, it is probable that the cost of lifting the small increase in daily production gained by an overpumped condition exceeds the value of the additional oil.

Problems with Mechanical-Lift Methods

The discussion of specific deep-well pumping problems will be limited to mechanical or positive-displacement lift methods. A majority of the problems discussed will be those experienced with rod pumping, which is not meant to imply that problems associated with other lift methods are less severe or occur less frequently.

Lifting cost control . . . The costly problem associated with mechanical-lift methods is mechanical failure of surface and subsurface equipment. Lifting costs consist of certain fixed costs, such as overhead and taxes, and direct operating expense. With rod pumping or any pumping method, it is the direct operating expense that must be studied and controlled. These costs consist of materials, surface and subsurface maintenance, and lease labor. The primary consideration here will be the problems experienced with lift-equipment operation and maintenance and the control of such problems.

Initial production decline . . . The first problem that an operator might encounter with a deep-lift pumping installation is a rather constant decline in production for no apparent reason. For example, during the first month of operation the production rate may have dropped from 240 to 200 bbl. of fluid per day with the same equipment and a constant rate of operation. It is very probable that the decrease in production is caused by a decline in the working fluid level and nothing more.

In most cases fluid levels are high when pumping installations are first completed. However, there is an initial drawdown of fluid level in any well. If the well in question has poor reservoir communication, it is possible that this decline in working bottom-hole pressure and fluid level will occur over a rather lengthy period of time. A similar condition can exist in a well that

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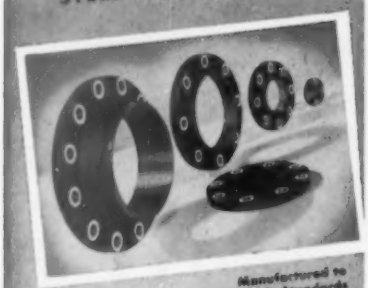

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Wider, Deeper Frame Gives Greater Clearance Over Spectacles

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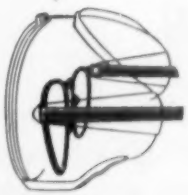
Workers who wear prescription glasses—even the new, big plastic frames—will welcome its extra roominess. Transparent frame is tinted light green to keep out glare, but admits adequate side light. Clear or green plastic lenses are securely held in place by a deep channel and closed "tab pocket".

Ask your Willson distributor to show you the new No. 90A Series MonoGoggles, available with either direct or indirect ventilated frames or non-ventilated styles. Or write for bulletin.



Side view shows molded-in grooves in sides of frame provide ample clearance for spectacle temples—removes interference with eye glass comfort.

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TYPICAL APPLICATIONS:

Figure 1. *Down-hand welding of flanges.*

Photo courtesy of National Tank Co., Tulsa, Okla.
Figure 2. *Welding of end flange to cylinder.*

CHECK LINCOLN'S NEW LOW PRICES

Lincoln's new combination of lower AC welder prices and faster welding with "Jetweld" can cut your welding costs. See for yourself. Have your Lincoln representative check your requirements for electrodes and welders. Call or write.

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has good reservoir communication if the reservoir mechanism is a solution gas drive and the reservoir pressure is dropping rapidly, but for this example the initial, rapid drawdown is followed with a slower decline during remaining well life.

As the working fluid level drops, the fluid load on the pump increases which means that the stretch in the rods on the upstroke increases. The result is a decrease in plunger stroke and production. With deep pump submergence, pump efficiency will be high since the pressure which forces fluid through flow restrictions and into the pump is high. It might be stated that the pump is precharged. Also, with deep pump submergence there is less possibility that free gas will be present in the pump to decrease volumetric efficiency. As pump submergence is lessened, the pump volumetric efficiency is decreased. The efficiency may drop from more than 90 to less than 70 per cent with a pump in good mechanical condition.

When pump is pulled . . . On occasions a pump is pulled because of a drop in production resulting from fluid level decline only to find that the pump is in good working order. There will be evidence of normal pump wear in any case. Only slightly worn valves, barrel, and plunger might be replaced to insure that the pump is as good as new. In the meantime, the well has been shut in and the bottom-hole pressure has been building up so that when the well is again pumped, a higher production rate is initially experienced. Therefore, it can be seen that the cycle explained could continue. The net result is excessive lifting costs.

The following are results of calculations which illustrate the cycle discussed. The example well is equipped with a tapered 1-in., ⅞-in., and ¾-in. rod string and a 1½-in. plunger insert pump set at 10,000 ft. Calculated production with a working fluid level near 3,000 ft. and five 20-ft. s.p.m. is 285 bbl. of fluid per day. With a working fluid level at or near 6,300 ft., the calculated production has decreased to 240 bbl. of fluid per day operating at the same speed.

Finally, with a working fluid level near 9,600 ft., calculated production is only 200 bbl. of fluid per day with five 20-ft. s.p.m. Pump volumetric efficiency was assumed to be approximately 90 per cent with the working fluid level near 3,000 ft., 80 per cent with the fluid level near 6,300 ft., and 70 per cent with the fluid level at 9,600 ft.

Surface equipment . . . Maintenance of both surface and subsurface equipment

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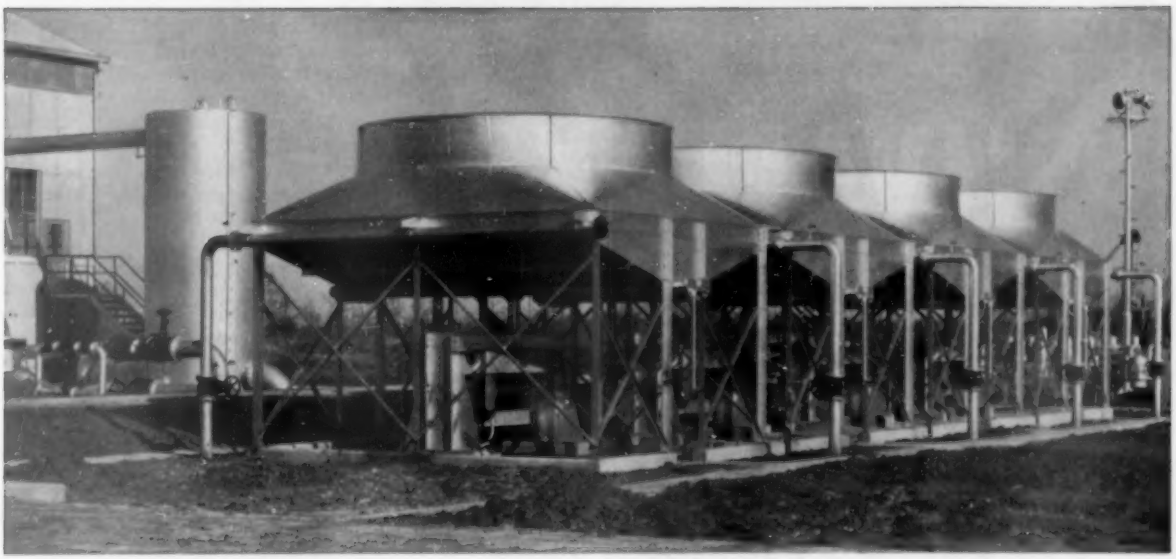
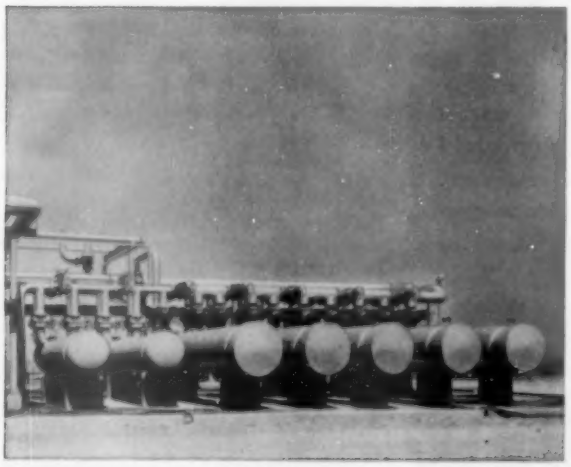
TOUGH FABRICATING JOBS are handled with ease in Alco's fully equipped shops, where virtually any type of equipment can be built at realistic low cost. Here a section of steel pipe, mounted on a universal-position pedestal, has flanges attached by submerged arc welding.

Processing problems



JACKET WATER COOLING for compressor engines on cross-country pipeline is efficiently performed by Alco Aircoolers even during summer's high ambient temperatures. Available in radiator-core and fin-tube types, Alco Aircoolers offer lower costs in scores of applications.



ALCO GAS COOLERS serve two absorption towers working in parallel at Lion Oil Company's Diamond M-Sharon Ridge gasoline plant near Snyder, Texas. Geared to produce 375,000 gal of petroleum products per day, Diamond M uses 39 Alco shell-and-tube heat exchangers of 21 separate types.

GRANGEMOUTH, SCOTLAND, is one of the world's oldest petroleum refining centers, with shale oil processing dating back over 100 years. At this historic site, Anglo-Iranian's refinery included 18 types of Alco heat-exchange equipment in its extensive expansion and modernization program.

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Spongy, flake-like granular material . . . shown actual size.

NEW LOW COST BRIDGING MATERIAL

This spongy, flake-like granular material forms an impervious seal in combating lost circulation. It is a complete bridging material alone, giving good performance with limited usage. Silvaflake will not deteriorate, sour or decay and has no adverse effect on mud properties. It pours readily from easy-to-handle 50-lb. bags. Due to the wide range of particle size and shape and its natural plasticity, Silvaflake forms an effective seal that prevents further loss of mud and/or mud filtrates to fractured and vugular formations. The seal thus formed effectively prevents further hydraulic breakdown of the formation. Other Weyerhaeuser products to combat lost circulation include:

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constitutes the major part of operating expense with deep-well pumping installations. Daily maintenance of surface equipment is of primary concern to the pumper. If a pumping unit is properly sized for pumping conditions, there should be little difficulty or few failures with surface equipment. This is especially true of conventional crank-balanced beam pumping units. Experience indicates more maintenance is required for the hydraulic pumping jack or the air-balanced beam unit. Also, if the prime mover is properly sized, it should give little trouble.

It should go without saying that the pumper should diligently follow company policies or the manufacturer's recommendations for servicing equipment. The specified or equivalent lubricants should be used. This is not only important to insure maximum equipment life, but it will eliminate the question of improper lubrication in the event of equipment failure. There have been instances of a chassis lubricant being used in bearings on a pumping unit that were designed to run in a gear lubricant.

Electric-motor operation does not present many problems. The operator should be sure that the motor has proper lightning, short circuit, and overload protection. It is not uncommon for the motor control panel to be equipped with relay heaters which are rated too high for the motor installed. A rod break or any condition causing overload could then result in burned windings.

Gas-engine operation should be within the maximum and minimum speeds recommended by the owner or the manufacturer. For best results, the engine load should be equal to or slightly less than recommended by the A.P.I. Multicylinder engine manifold vacuum is the best field indication of engine load. Crankcase-lubricant changes and filter changes should be made according to company policies or manufacturer's recommendation for local conditions. The manufacturer's recommendation for total hours' operation between oil changes can usually be considered a minimum. The engine should be maintained in good running condition because an engine operating poorly is probably overloaded and overloading causes excessive wear.

Counterbalance important . . . A cause of excessive engine and pumping unit wear is an improperly counterbalanced condition. On a deep lift, very large peak torques or reducer loading can result if the unbalanced condition is severe. For example, if only two-thirds the effective counterbalance needed was used on a 10-ft.-stroke beam pumping unit, the peak torque would be ap-

You'll get the job done better when you give good men good equipment

Production Men might never actually own a barrel of production . . . but they take great pride in their ability to lift oil efficiently, economically, safely on leases that are equipped in a manner that properly reflects their "know how."

In fields of medium depth and pressure . . . where most often the ingenuity of the Production Man is taxed . . . Larkin Tubing Heads and Larkin Casing Heads are great favorites.

The versatility of the Larkin Type SR Tubing Head shown here gives him a 4500 p.s.i. test head that is readily adaptable to any flowing, gas lifting or pumping condition. It is easily converted to Type R, with stripper, or Type M, mandrel suspension. All parts for all sizes of heads are interchangeable. When used in combination with the Larkin 2000 p.s.i. test Fig. 91 Casing Head, Larkin Tubing Heads provide a compact, safe, workmanlike hookup that will serve for the life of the well.

Give good men good equipment — "Through Your Supply Store."

50th Anniversary Year

LARKIN

...Through Your Supply Store

LARKIN PACKER COMPANY, INC. • ST. LOUIS, MO.

IN TEXAS George Novak, sales engineer (left), talks with a driller about field handling of casing and drill pipe. Here he discusses a new product development with the director of an oil company drilling engineering division.

In The Oil Fields . . .

It's Extra Service That Counts

You play for big stakes in the oil fields. Every drilling operation is a gamble and you are continually striving to reduce the odds.

That's where Pittsburgh Steel's sales engineers fit in. If you drill for and produce oil, the sales engineer's job is to make sure that you are satisfied and happy with every length of Pittsburgh drill pipe, casing or tubing you receive and that it gives you the kind of service you want in the field.

In one day the sales engineer's range of assignments may include: (1) Computing specifications and designing oil strings for independent operators who do not have engineering staffs, (2) taking orders, (3) making sure the operator is satisfied that shipments meet specifications, (4) assisting field shops in the proper threading

IN OKLAHOMA Sales Engineer Jewel Smith (right) checks threading to make sure that . . . Pittsburgh Steel products will perform satisfactorily for all types of drilling and production.

of tubular material and application of necessary field equipment, (5) schooling field crews in proper handling and installation, and (6) observing the running of casing and tubing to insure proper performance.

Beyond that, they frequently will be working with other engineers and drillers on the technicalities of a planned drilling operation. Often they are busy developing new products or introducing new products to drilling contractors and engineers.

George Novak (above) from Houston, for example, helped to develop a new tubing for use on high pressure completion jobs. He and an engineer for an oil company jointly worked out the specifications for tubing capable of withstanding excessive working pressures. That tubing put the oil company, and eventually the industry, years ahead in development. For Novak, it was one more in a long and impressive string of oil field "firsts" he has worked on.

● **It has to be right**—Recently John Wais Jr. (right) from Los Angeles, has been working with operators who are using Pittsburgh's lightweight, high-strength seamless drill tubing to reduce drill pipe weight. Field requirements and mill problems have to be coordinated to work out the most suitable dimensions and designs. Wais goes over these requirements with customers, makes suggestions on the design and explains what can be done by the mill to obtain the best product for these requirements.

Jewel Smith (left) from Tulsa, is busy giving the same kind of service, ranging over thousands of miles, to visit oil men on the job. This 215 pound, six-foot-three, former oil field "roughneck" can't walk past a quantity of stored Pittsburgh Steel products—already sold and delivered—without getting measuring devices out of his car and testing to make sure the customer is getting what he asked for.

IN CALIFORNIA On arrival of a shipment of casing, Sales Engineer John Wais Jr. (center above) works with inspecting crews to be sure they are satisfied. The same day finds him (below) discussing technical problems with a drilling superintendent and drilling engineer for an oil firm.

Sales engineers like Novak, Wais and Smith are the liaison men between Pittsburgh Steel's steel mills and the oil men's field operation. If you have a problem that involves the use of drill pipe, casing, or tubing, or other operational problems—these men, plus the sales staff and the mill men at Pittsburgh Steel—are ready to do what they can to help you arrive at the right answer.

And you can count on them to follow through to see that performance on the job is up to your expectations. They know that, after all, it's the follow-through that counts most in the oil fields.

"Everything New But The Name"

Pittsburgh Steel Company

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. . . and it's easy to do, even at long range, through The Canadian Bank of Commerce, one of the world's larger banks. We are close to the pulse of all developments in Canadian oil through our own alert, fully-equipped Petroleum and Natural Gas Division in Calgary.

Moreover, with more than 140 of our branches in the great sedimentary basin of Western Canada, we are in constant touch with local operations throughout that area.

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proximately 720,000 in.-lbs. as compared with 360,000 in.-lbs. with the correct counterbalance. This is for a 9,000-ft. lift with a 1½-in. plunger operating at 9 s.p.m. The example is an extreme case, but it does give an indication of that which is possible. The A.P.I. rating of the speed reducer which probably would be in use on the example well is 456,000 in.-lbs. peak torque capacity.

It is essential that pumping-unit installations be level and properly aligned over the well if best results are to be obtained. This is especially true for big pumping jacks. If a beam unit is not properly aligned and level, bearing life will not be satisfactory. Also, it is possible for conditions to be such that there is not enough unit adjustment available to permit proper polished-rod alignment in the tubing. Because of the high polished-rod load, such a condition will mean short stuffing-box packing life.

The problems which can exist with surface equipment are usually relatively simple to correct. However, proper attention to these problems will reduce lifting costs which otherwise may be considerably in excess of normal costs.

Subsurface equipment . . . A major part of the direct lifting expense is subsurface maintenance. Long-stroke beam and long-stroke hydraulic pumping units are in use for deep-well rod pumping to lower peak rod stresses, reduce rod fatigue, and increase pump efficiency. This makes possible lower lifting costs and deeper lifts. The initial investment is considerably higher than that which would be necessary for a shorter-stroke installation. Since additional capital was invested to gain additional stroke length, it is only reasonable to expect the pumper to utilize the longest stroke for as long as possible. Limitations on sheave sizes and prime mover minimum speed will make it necessary to reduce stroke length prior to and during the "stripper" stage of production in order to prevent severe over-pumping. For the deepest lifts, rod stresses are still high, and any unusual condition is likely to cause rod failure.

A Common Misconception

To understand the problems involved more clearly, it is best to dispel the idea that deep pumping is slow pumping. For example, the average polished-rod velocity with a 30-ft.-stroke hydraulic pumping unit operating at 6 s.p.m. is approximately the same as that of a 64-in.-stroke unit operating at 34 s.p.m. or a 74-in.-stroke unit operating at 29 s.p.m. The rate of operation

AN ENGINEER LOOKS AT W-K-M VALVES

On STEMS and CORROSION

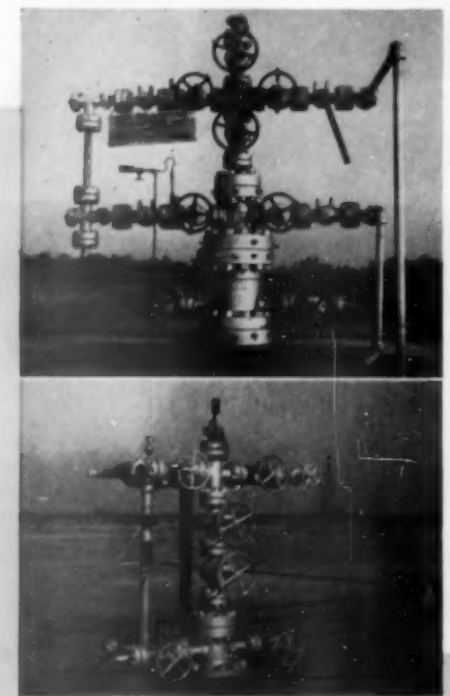
STEM NO. 1 STEM NO. 2 STEM NO. 3

These three stems have quite a history:

STEM NO. 1
2½", 3000 p.s.i. test Model F Valve. Twelve years of sour crude service. Stem condition is excellent; failure is purely mechanical and occurred in an attempt to open the valve when it was already open.

STEM NO. 2
2", 3000 p.s.i. test Model F Valve. Six years of sour crude service. Stem is like new.

STEM NO. 3
2", 3000 p.s.i. test. Failure due to corrosive action of extremely sour crude after two years of service. This is a materials problem solved by replacing the standard 4140 alloy steel with a stainless or K-monel stem.



The moral here is, that standard W-K-M Valves will stand up under sour crude service — but, a check on the type of crude is often wise before installing valves for permanent service, as the use of proper trim at the beginning can prevent an emergency shutdown later. Also, as a general practice, it is well not to switch valves from field to field without making sure that the trim is suitable for the service.

There is a W-K-M Valve made for every oilfield use. Specify W-K-M to be sure.

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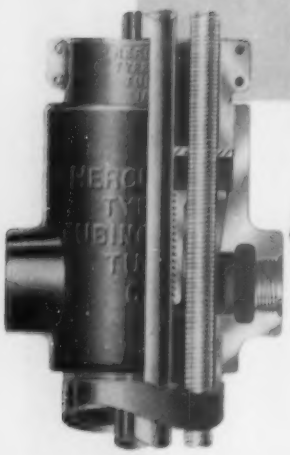
IN MEDIUM DEPTH WELLS

HERCULES "TYPE J-5-R" AND "RC" TUBING HEADS

DESIGNED FOR USE WITH REDA PUMPS



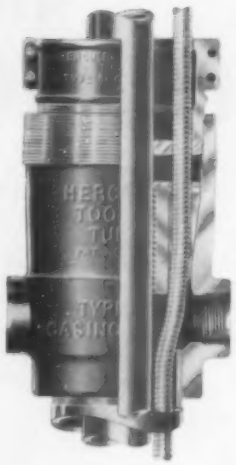
"TYPE J-5-R" TUBING HEAD

Designed for medium depth wells. Will suspend 5000 feet of 2" or 2½" Tubing or a proportionate amount of 3". Available in casing sizes from 5½" OD (which will suspend 2" or 2½" tubing only) to 7" OD which will suspend 2", 2½" or 3" tubing. Pressure cast steel body hydrostatically tested to over 4000 psi. 2" LP outlets furnished. (3" optional). Approximate over-all height, 14½".

Both heads feature the positive aligning hinged slips (which allow the electric cable to pass through the slips close to the tubing) and the overhead packing arrangement which packs off the tubing and electric cable simultaneously. The packing arrangement in both heads is tested to 2000 psi.

IN DEEP WELLS

Built to support the weight of 10,000 feet of 2", 2½" or 3" Tubing, 5,000 feet of 4", or 4,500 feet of 5½" Casing. Available in casing sizes from 6⅝" to 9⅝" OD. 3" side outlets furnished. Pressure cast steel body tested to 4000 psi. Approximate over-all height, 23".



"TYPE RC" TUBING HEAD

SOLD AT ALL SUPPLY STORES

SINCE 1924

HERCULES TOOL COMPANY

Manufacturers of Oil Field Equipment

GENERAL OFFICES AND PLANT • TULSA, OKLAHOMA

Export Representative Oil Field Equipment Co., Inc. • 30 Church Street, New York, N. Y.

given for the short-stroke units would not be practical.

Don't overstress rods . . . Sucker-rod failure can be a costly problem. This failure cannot be eliminated in deep pumping, but it can be controlled. The cause of rod failures is overstressing. Since sucker-rod stresses are high in a deep-pumping well, there are many factors which can contribute to conditions in a well to cause excessive rod failures. Some of the factors which might add load to the already highly loaded rod string are crooked-hole conditions, excessive pump friction, a sticking pump, paraffin in tubing, corkscrewed tubing, and excessive operating speeds. With the exception of a crooked hole, these conditions can be corrected. If left uncorrected, one of the factors, such as a sticking pump, might add sufficient load to cause rod stresses to exceed safe values with failure resulting.

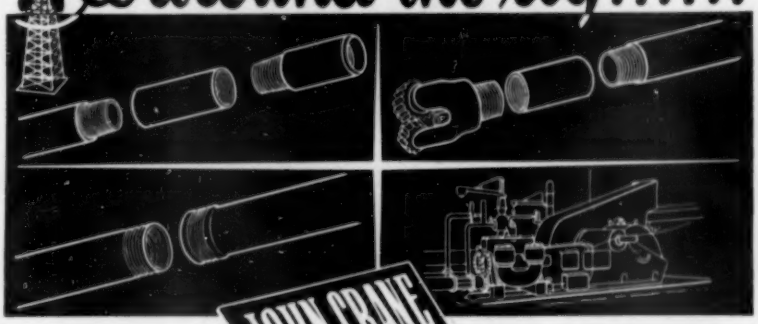
There are factors which will reduce the safe operating stress of a given rod string. Improper rod handling which results in bent rods, nicked rods, or hammer-marked couplings will cause stress raisers or stress concentrations. When one of these conditions exists the stress of the concentration will probably exceed the same (endurance limit) stress and the rod will fail in fatigue. If a rod is bent, the work load will tend to straighten the rod which adds a bending stress to the already highly stressed rod.

Coupling makeup is also important in a deep, rod pumper. A pin will not fail in fatigue if the makeup load exceeds the load to which the coupling is to be subjected since there will be no stress variation in the pin. Excessive makeup can start a fracture which will result in pin failure. Therefore, it is important that rods be handled carefully and that connections be cleaned and made up properly.

Control corrosion . . . Corrosion is a problem in some wells. Pitting of rods can cause stress raisers and subsequent corrosion fatigue failure of the rods. When such a condition is present in a well, treatment using chemical corrosion inhibitors is normally employed. If such treatment does not control failures, it is necessary to reduce rod stresses.

Don't load in compression . . . Sucker rods are designed to operate in tension. Being a slender column, a rod string will buckle and bend under compressive loading. Compressive loading or the higher variation in tensile loading as caused by a gas or fluid pound will greatly reduce rod life. Consequently, a well should not be pumped with a fluid pound. When a rod string parts, it is very probable that a few of the

All around the rig.....



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*PLASTIC LEAD SEAL

for tool joints, rods, tubing casing and all other threaded connections and gaskets.

All-Purpose PLS non-hardening lead-base compound permanently protects and leakproofs all connections even at abnormally high pressures. Yet, it lubricates as it seals . . . prevents seizing . . . allows easy disassembly of joints at any time . . . eliminates galling and rust. PLS is insoluble in all petroleum products . . . never washes out . . . is economical to use, since it outlasts ordinary compounds and less is required to give a perfect seal. In 1, 5, 15 and 28-lb. pails.

Test prove PLS at our expense. Send for free sample today.

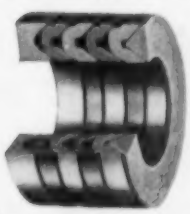
JOHN CRANE Style 8820 EVERSEAL "V" PACKING

especially fabricated for positive sealing, long-lasting operation on mud pumps.

Constructed of alternate homogenously molded graphitized asbestos material and synthetic rubber rings, with male and female adaptors. Special "V" design insures automatic sealing action at high or low pressures. Pressure chambers between rings break down total pressure and act as reservoirs which hold the liquid lubricant next to the plunger, thus reducing friction. Flexible lips automatically force against the rod on the pressure stroke and release on the suction stroke.

Carried in stock in all popular mud pump sizes.

Send for full information today.



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Crane Packing Co., Ltd., 617 Parkdale Avenue, N., Hamilton, Ont.

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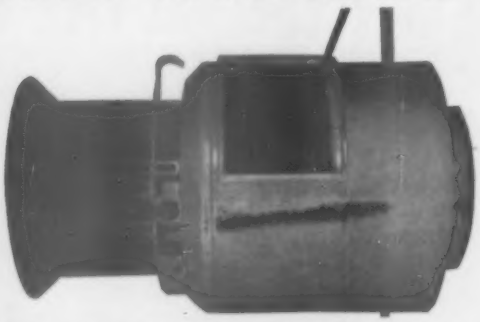
KELCO

Safety



BREAKOUT AND SPINNING LINE CATHEADS

KelCo Safety Breakout Catheads are available in two sizes—Model 12 for light drilling rigs and servicing hoists—Model 16 for medium and heavy drilling rigs—choice of mechanical, hydraulic or air controls on either model. Tong line and patented tong block furnished at no extra charge.

AVAILABLE THROUGH YOUR FAVORITE SUPPLY STORE

Representatives in All Fields

Be Safety Wise—KelCo-Ize

KELCO BEN F. KELLEY CO., Inc.
TULSA, OKLAHOMA

SPINNING LINE CATHEADS • BREAKOUT CATHEADS • AIR OPERATED POWER SLIPS • TUBING TONGS • SAFETY "C" POLISHED ROD CLAMPS

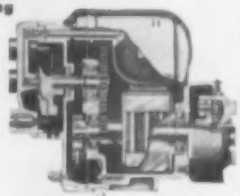
CONTINUOUS PUMPING ENGINE OPERATION DAY AFTER DAY

Change the present magnetos on your pumping engines to Fairbanks-Morse Super Spark Magnetos and eliminate costly ignition failures. Fairbanks-Morse Magnetos are tops in economical performance and dependability—proven by years of severe oil field service—built by Fairbanks, Morse & Co., manufacturers of superior products for over 120 years.

Switch to Fairbanks-Morse Super Spark Magnetos and forget about ignition failures. See your Fairbanks-Morse service station or distributor or write Fairbanks, Morse & Co., Magneto Division, Beloit, Wisconsin.

BUILT TO TAKE A BEATING

- Compact, rugged, self-contained unit—few working parts
- Sturdy impulse coupling of simple design for easy starting
- Alnico Super Magnets cast into powerful one-piece magnetic rotor
- Steady hot spark at all speeds
- Large, long lasting breaker points for quick starts—smooth performance
- Oversize high tension coils—built to take a beating



This is type FM-XOR six cylinder magneto with ball bearings throughout—available in base or flange mounting.

FAIRBANKS-MORSE
a name worth remembering when you want the best

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smaller rods below the part will be damaged as a result of the string being dropped in the tubing. If the bent or corkscrewed rods are not replaced, it is possible that bending stresses could cause future failures.

Watch pump maintenance . . . Another costly item in deep-well pumping is bottom-hole-pump maintenance. Pumps must operate at relatively high velocities with a very high differential pressure across the plunger. These normal operating conditions in a deep-pumping well reduce useful pump life considerably below that which can be expected with a shallow lift. Therefore, as would be expected, the bottom-hole production unit or pump-repair frequency increases with depth of lift. Added to the increased frequency is the higher cost per job to repair the longer and more expensive pumps employed for deep-well lifts and the higher cost to pull and rerun a pump. The development and utilization of better bottom-hole production units are needed to decrease the repair frequency.

Condition Subject to Field Control

The pump-repair frequency is sometimes increased by conditions which are subject to field control. As previously discussed, overpumping will reduce subsurface equipment life. A severely corrosive well condition will increase the pump-repair frequency, but this condition is subject to control by using chemical corrosion inhibitors. Sand, shale, or other foreign material in produced fluid creates a troublesome problem which is difficult to control. Such foreign material can cause excessive wear, sticking plungers, or stuck pumps. A critical examination of the well conditions and pump failures might indicate a solution which will increase the length of pump runs.

Install tubing anchor . . . Tubing anchors are in general use with rod pumpings. A properly installed anchor will increase effective plunger travel and decrease tubing fatigue. Operators are

"Credit references, yes! I owe every drilling company in the country."

FOR BETTER CONTROL
USE BS&B CLIMAX
TYPE 86-TW DIAPHRAGM OPERATORS

STANDARD 6½"
OR JUMBO 10"
TOPWORKS

SPRING LOADED
AIR OPERATED

This versatile Climax Type 86-TW Diaphragm Operator is a modified version of the controlling mechanism of the famous BS&B Climax Type 86 Control Valve. It has been adapted for use with a variety of other valves, instruments and controls such as butterfly valves, diaphragm valves (Saunders Patent), engine throttles and other controls where controlling pressure is available for translation to reciprocating motion.

Available in either the Standard 6½" or Jumbo 10" size, this versatile topworks is spring loaded and operates from compressed air or other medium. Yoke, spring case, diaphragm case and plate are of high tensile cast iron. Stems are of stainless steel with bronze connector of unique construction. Diaphragm is of cotton or nylon neoprene. Roller bearings on the spring guide reduce friction loss to a minimum.

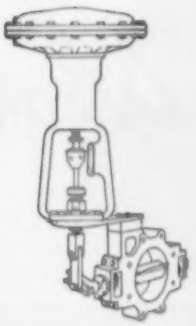
For more complete information on the Climax Type 86-TW Diaphragm Operator or on other Climax Controls, ask your BS&B Man or Sales Representative, or write to . . . .

CLIMAX BS&B CONTROLS OVER 60 YEARS

BLACK, SIVALLS & BRYSON, INC.

Climax Controls Division Dept. 4-A10.

7500 East 12th St. Kansas City 26, Missouri

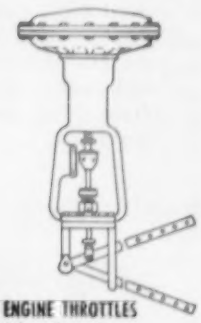


FOR BUTTERFLY VALVES

Climax Type 86-TW Diaphragm Operator is ideal for automatic control of butterfly valves. Mounts easily on any make of valve, and can be set for any specified operation of the valve.

FOR DIAPHRAGM VALVES

First developed for use on diaphragm valves, Climax Type 86-TW Diaphragm Operator has large diaphragm area and variable spring loading to insure minimum hysteresis.



FOR ENGINE THROTTLES and Other Controls

Wherever a sensitive yet positive reciprocal controlling motion is needed, such as on engine throttles, speed governors, cooling tower weirs, valve levers, etc., the versatility and adaptability of the Climax Type 86-TW Diaphragm Operator make it the ideal selection.

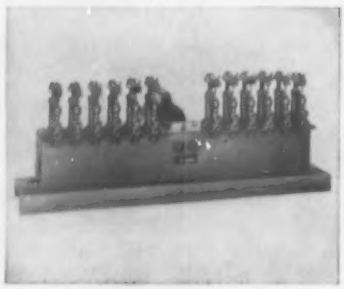
What's Your Problem?

PRESSURE LUBRICATION?

Manzel Force Feed Lubricators are known throughout the Oil and Gas industries for their dependable, economical operation in putting the right amount of lubricant, precisely where it's needed, with the exact frequency required. If you have specific, difficult problems, Manzel can solve them with specially engineered installations.

CHEMICAL FEEDING?

Here, again, the Manzel organization has wide experience in meeting the peculiar needs of the Oil and Gas industries with Chemical Feeders of proven dependability under the most exacting operating conditions. Models are available with single or multiple feeds and with capacities of from a few drops to 60 gallons per hour.



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Engineered To Your Specific Needs

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For Applying Lubricants to Tool Joints, Drill Collars, Drill Tubing, Casings and Tubing

- √ *prevents contamination*
- √ *reduces lube consumption*
- √ *cleaner and safer*
- √ *quicker round trips*
- √ *increases service life*
- √ *measured lubrication*
- √ *drum off working floor*

JET-LUBE APPLICATORS will pump any kind of lubricant which will seek its own level... which will not settle out under vibration... and which can be pumped at sub-zero temperatures.

JET-LUBE's "550", "21" and KOPR-KOTE meet all these requirements

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Jet-Lube of Canada Ltd., Edmonton, Alberta

using mechanical and hydraulic anchors for various reasons. For most installations, it is desirable that the tubing be in tension to the pump in order to avoid a corkscrewed tubing condition. This undesirable condition will result if an anchor works up the hole, and a check should be made for this when tubing is pulled. In the event that a hydraulic anchor is in use, a drain collar might prove to be valuable. Hydraulic anchors should be reconditioned when pulled to avoid leakage. In the event that a tubing anchor is set in casing above the cemented section, it should be remembered that the string will be subjected to a working stress for which it was not designed.

A further difficulty with pump operation is seating equipment. A common practice is to provide a bottom lock and seal and a top seal and stabilizer. If properly spaced, this arrangement gives satisfactory operation. In the event of pump change, it is important that seal-cup spacing be the same as that initially used. This will reduce the possibility of an improper pump seat and fluid leakage past the pump.

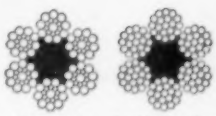
Check hydraulic systems . . . Essential to satisfactory hydraulic production unit operation is clean power oil. Proper treating facilities should be provided, and power-oil tank bottoms should be kept clean of water and deposition. Operating pressures should be kept to a minimum by proper pump selection and by keeping lines clean of paraffin. A minimum of oil should be bypassed at the power-oil pump, because bypassed oil is wasted energy.

An operating problem with hydraulic pumping which deserves mention here is maintenance of a pump with a free system. With this system, the production unit can be pumped to the surface. Because of the ease and speed with which a pump can be removed, it is probable that more "green" pumps are pulled. Replacement of a pump still in good condition adds unnecessary lifting costs.

Use a dynamometer . . . When subsurface failures are frequent, a well study can be profitable. A useful tool for such studies is a dynamometer. The dynamometer card is a continuous recording of polished-rod load during the pumping cycle. Card shape is influenced by many factors. An abnormal condition will be indicated on the card, and it is usually possible to determine the subsurface difficulty by careful analysis of the card. Cards recorded during normal operation are useful in the study. Also, fluid-level surveys give data which are valuable for well studies.

ABRASION often gives wire rope a beating. Rope is squeezed under tremendous pressure on rotary drilling drums in Texas oil fields. In the Northwest it drags under heavy logs. In mining it is scraped over rocks to operate slushers. Everywhere it is rubbed severely on winches that do not wind smooth. Under such conditions Red-Strand 6 x 19 Seale wire rope lasts longer and saves money.

What can you do better with 6 x 19 Seale Red-Strand?



6 x 19 Seale 6 x 19 Filler Wire

6 x 19 Seale has the same strength and weight as the more frequently used 6 x 19 Filler Wire, but the arrangement and size of the wires is different. You can see in the diagrams that the outer wires are fewer in number and larger in size. They provide *high resistance to abrasion* and greater wearing quality with somewhat less flexibility.

It's the perfect rope for certain jobs. Would it solve a problem for you? Be less trouble? Save more money? A Leschen man is near you. Perhaps he can help. Leschen is providing *longer-than-expected* wire rope service to industry everywhere.

Send for the 64-page Leschen Wire Rope Handbook. It describes Seale and all other Red-Strand wire rope constructions.

LESCHEN WIRE ROPE DIVISION
The Watson-Stillman Company
(A SUBSIDIARY OF H. K. PORTER COMPANY, INC.)
St. Louis 12, Missouri

LESCHEN
HERCULES Red-Strand
WIRE ROPE

CARDWELL

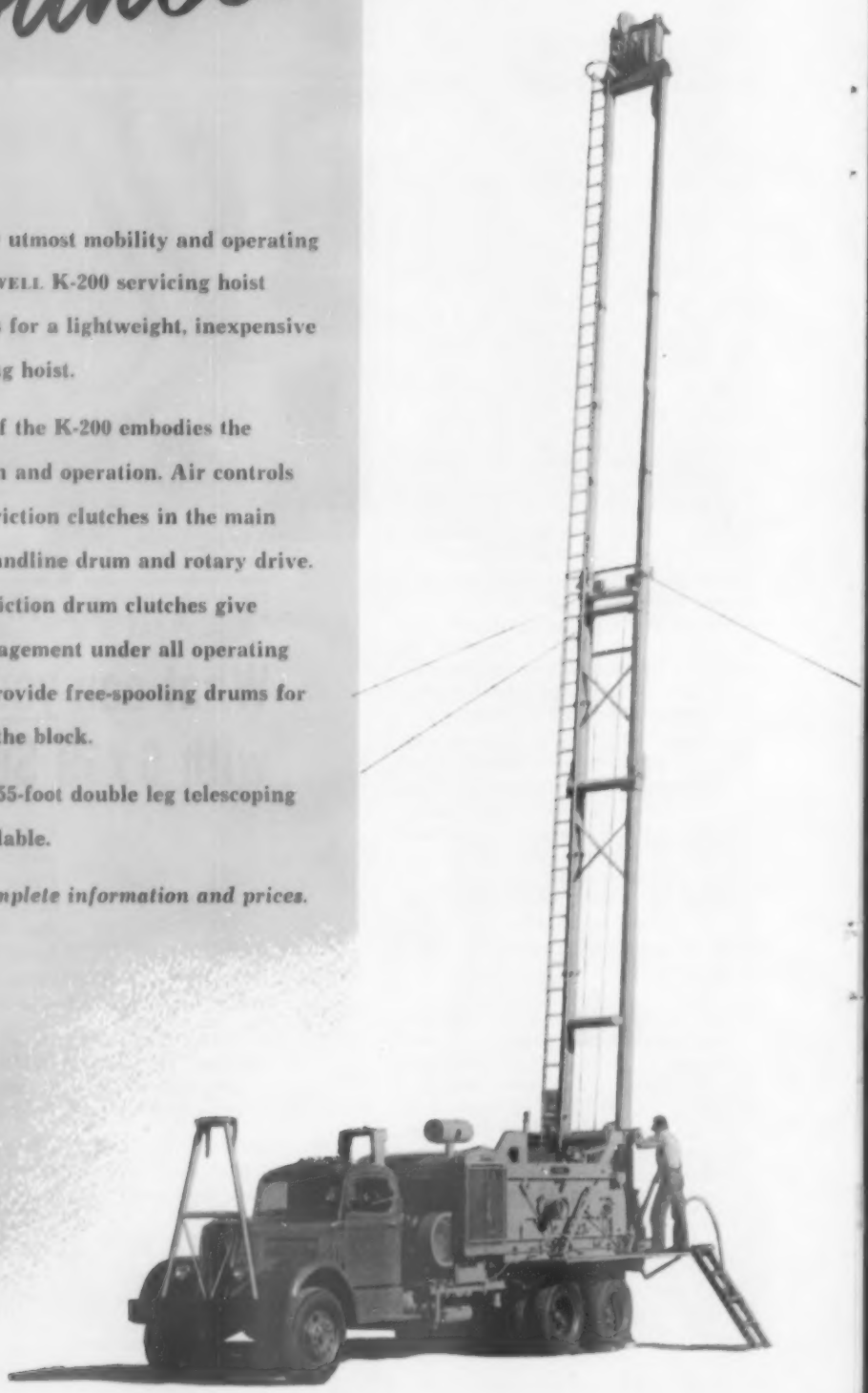
Announces the New

Designed for utmost mobility and operating speed, the CARDWELL K-200 servicing hoist meets your needs for a lightweight, inexpensive 200-H. P. servicing hoist.

The design of the K-200 embodies the simplest of design and operation. Air controls operate the air friction clutches in the main drum, optional sandline drum and rotary drive. CARDWELL air friction drum clutches give fast, positive engagement under all operating conditions and provide free-spooling drums for fast dropping of the block.

A 65-foot or 55-foot double leg telescoping pipe mast is available.

Write for complete information and prices.



K-200 *Servicing Hoist*

FEATURES

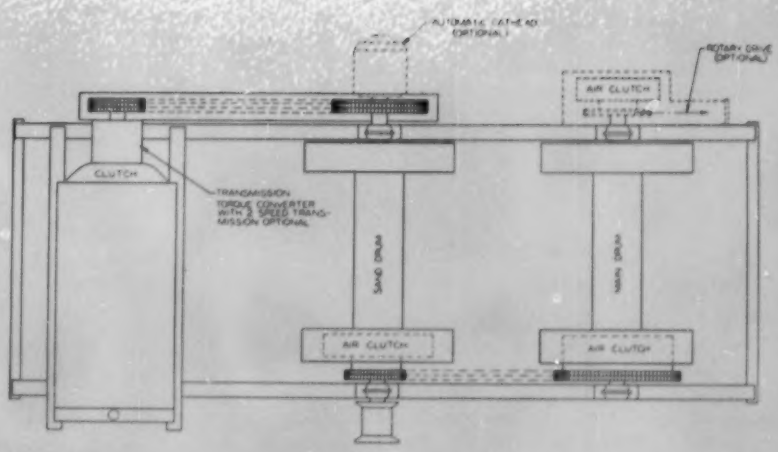
CARDWELL air friction clutches in main drum, optional sandline drum and rotary drive.

Transmission provides four-speeds forward and one reverse to both drums.

Free-spooling drums, mounted on double row, self-aligning bearings.

65-foot or 55-foot double leg mast telescopes and folds over the hoist. Mast is raised and extended by line from winch which is driven by truck engine.

K-200 is available with GM 6031-C or Waukesha 145GKU engine, and can be mounted on a WC-2264 White, RF-195 International or 800-Ford truck.



CARDWELL

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THERE IS A CARDWELL PARTS STOCK NEAR OR IN EVERY OIL FIELD OF THE WORLD

EQUIPMENT MEN . . . in the News

Moorlane, Braden Announce Executive Appointments

L. P. FAGAN

The board of directors of Moorlane Co. and Braden Steel Corp., at meetings held in Tulsa, have each simultaneously made the following appointments and organizational changes effective October 1, 1954.

At Moorlane Co., Wm. D. Moorer, president, will be chairman and chief executive officer; E. L. Hagar, vice president and Tulsa branch manager, will succeed Moorer as president and operating officer; W. R. Thorpe, sales manager, has been appointed vice president and will be the new Tulsa branch manager; B. A. Mead, formerly manager of the company's Kansas City branch has been appointed vice president in charge of the Kansas City branch and sales territory.

W. D. MOORER

E. L. HAGAR

At Braden Steel Corp., Wm. D. Moorer, president, will be chairman and chief executive officer; L. P. Fagan, presently vice president, will be the new president and operating officer of the company; and M. G. Oliver has been appointed vice president and general manager.

Byron Jackson Acquires Rollin Co. Assets

Byron Jackson Co. has taken another step in the expansion of its Electronic Division with the acquisition of The Rollin Co., of Pasadena, Calif. Announcement of the purchase was made by E. S. Dulin, president of Byron Jackson.

Rollin has specialized since 1944 in the development and manufacture of high-precision testing equipment used to evaluate and standardize the performance of electronic operating equipment and measuring devices.

Paul J. Holmes, formerly president of Rollin, was named general manager of BJ Electronic Division, and will head the expanded activity. It was also announced that plans are under way to acquire or construct a new plant to house the larger engineering and manufacturing facilities.

Designed for large-volume fracture treatments, the above unit will be used by Dowell in West Texas.

Dowell Builds Fracturing Unit for Spraberry Wells

Oil companies in the past few years have increased the volume of sand and oil used on fracture treatments tremendously. Many Spraberry wells in West Texas are treated with 25,000 gal. of oil and 50,000 lb. of sand prior to completion, and in some instances 50,000 gal. of oil and 100,000 lb. of sand have been used. Occasionally these treatments exceed the pump capacity of the service trucks now in use.

In order to fill the demand on these large fracture jobs, Dowell Incorporated designed a 1,000-hp., trailer-mounted pumping unit that is the largest available to oil companies at the present time. This unit is powered by two 500-hp. Continental engines and has a combined output of 34 bbl. per minute at 1,700 psi.

Although designed primarily for fracturing, the pump unit can be used for acidization or cementing.

Dowell has four of these models planned; the first one is ready for service and will be used in West Texas, operating out of the company's Midland office.

Skelly Joins Wheland Engineering Staff

Lawrence E. Skelly has joined the staff of The Wheland Co., Chattanooga, Tenn., as engineering specialist. He was formerly chief engineer of Giffels & Vallet, Inc., in their Houston office.

Skelly has long been active in the design of plants and equipment for the chemical and manufacturing industries. His appointment augments the present services of Wheland in the design and manufacture of specialized equipment for these industries.

A. O. Smith Names Henry To Pacific Coast Post

F. A. HENRY

F. A. Henry, formerly assistant to the general manager of A. O. Smith Corp., has been appointed general manager of the corporation's Pacific Coast Works at Los Angeles. He succeeds A. W. Shuman, who has resigned.

The announcement was made by F. S. Cornell, vice president and general manager. Henry joined A. O. Smith in 1953. Before that he had been Air Force plant representative at the Wichita division of Boeing Airplane Co.

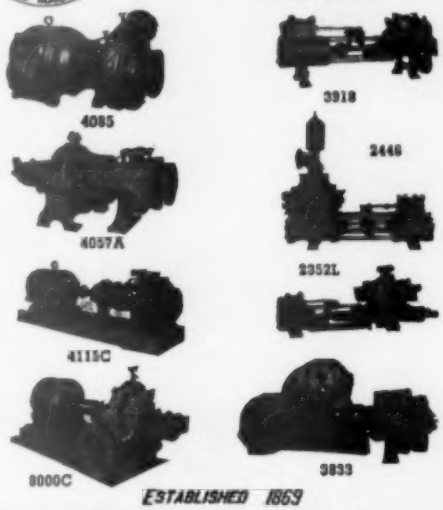
Homco Announces Changes In Sales Organization

Houston Oil Field Material Co., Inc., has announced the following changes in personnel.

W. I. Kerr has been made division superintendent in charge of services for

PUMPS

CENTRIFUGAL
RECIPROCATING
BUILDERS OF OUTSTANDING PUMPS
Since 1869



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VALVES
INDUSTRIAL • CHEMICAL • AIRCRAFT

What! PLUG VALVES THAT TURN EASILY AT 65° BELOW!! WITH NO LUBRICANT!!!

Up to 250°, down to −65° F, is the range of Republic's LO-TEMP selector valve. Easy turning, positive sealing, at pressures to 100 psi. Tapered TEFLON plug requires no lubricant, and is not affected by acids or alkalis.

Aluminum body for aircraft and general use, stainless steel for chemical, food, and dairy industries. Angle, 2, 3, 4-way, with or without drain, flanged for panel mounting.

Write for Bulletin No. 754. Distributors in principal cities from coast to coast.

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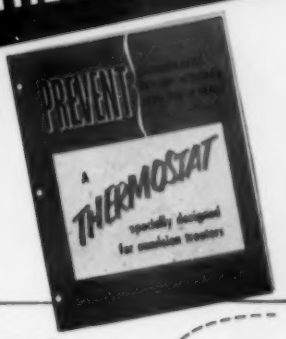
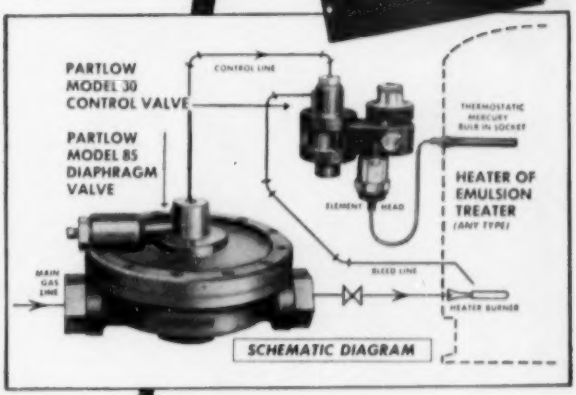
RM REPUBLIC MANUFACTURING CO.
15655 BROOKPARK ROAD • CLEVELAND 11, OHIO

Get the surprising facts on this money-saving PARTLOW THERMOSTAT





It's specially designed for Emulsion Treaters

SEND NOW for illustrated facts Bulletin No. 108. See how and why Partlow Thermostat Model 30-85, in exhaustive field tests, outperformed by far all conventional thermostats. During four full years of tests, this specially designed thermostat required no repairs or adjustments . . . saved thousands of dollars each year through accurate control that prevented bad tanks of oil, excessive oil loss and gravity loss. Partlow-engineered advantages like these make the difference:

1. **MERCURY THERMAL ELEMENT** provides powerful, positive control force.
2. **HEAVY-WALLED TUBING** reduces wind vibration.
3. **STAINLESS STEEL PARTS** resist corrosion.
4. **DIAPHRAGM VALVE** has no exposed moving parts to jam or break.
5. **SENSITIVITY** is less than 2° in 50°F to 350°F range — accurate under any heat loss condition.

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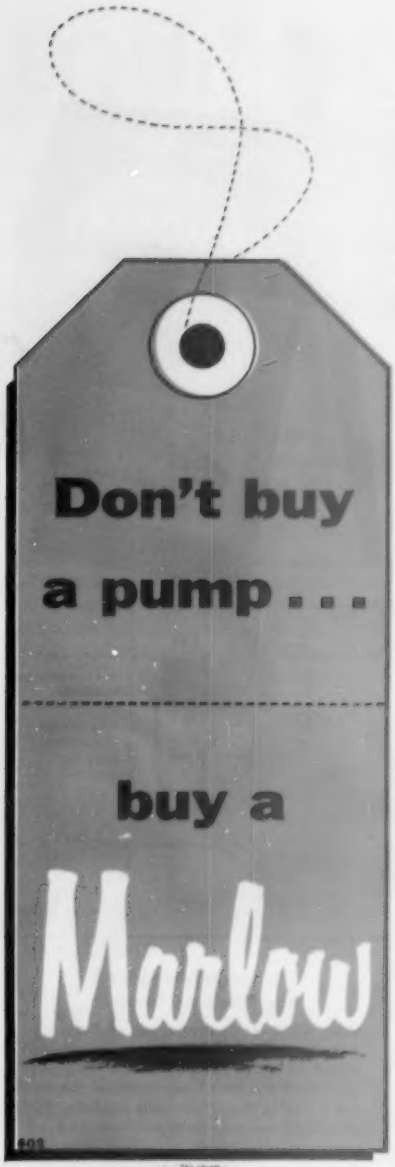


you get more . . . with a Marlow!

MARLOW PUMPS
RIDGEWOOD, NEW JERSEY

Division of BELL & GOSSETT COMPANY

West Texas, New Mexico area. Kerr will headquarter in Midland, Tex.

J. B. Floyd has been named district superintendent of services in the Hobbs, N. M., area.

Robert Chadderdon has been transferred to Denver, where he will assist Hal Roach, area manager, in the service tool division of Homco.

G.S.I. Division Heads Study New Equipment

In a 2-day technical conference held in early September at Dallas headquarters of Geophysical Service, Inc., G.S.I. division managers and supervisors from the United States, Canada, and Mexico studied new seismic field equipment and details of its operations and application.

They saw demonstrations of a new magnetic-recording system, the MagneDisc; a new conventional seismic amplifier, the HTL 7,000-series system; and a new high-resolution seismic system for shallow-reflection work, the HTL HR system. All are manufactured by Houston Technical Laboratories and were developed in conjunction with G.S.I.

The G.S.I. supervisory personnel also were brought up to date on results of research and development programs for geophysical instruments and interpretation techniques being conducted by G.S.I. and its associated organizations.

A main feature of the technical conference was study of a G.S.I. recording truck completely equipped for field operations with MagneDisc recorder and 7,000-series amplifiers. The truck began an extensive program of field testing and experimental work in mid-September.

R. W. Olson, left, president of Houston Technical Laboratories, and C. H. Green, president of Geophysical Service, Inc., check out a new G.S.I. recording truck equipped with MagneDisc seismic recording equipment at a G.S.I. technical conference held in Dallas September 3 and 4. Olson is holding a MagneDisc on which up to 100 channels of information can be recorded for immediate playback and reproduction.

Lufkin Names Richards As Assistant Sales Manager

J. E. GISSLER

The appointment of Cooper D. Richards to assistant sales manager with offices at the home office in Lufkin, Tex., has been announced by Lufkin Foundry & Machine Co.

Replacing Richards as district manager in Oklahoma City is Charles E. Dyer, who has been resident manager of Lufkin Machine

C. D. RICHARDS

C. E. DYER

Co., Ltd., in Edmonton, Alta., Canada, since 1949.

Moving to Canada as resident manager, replacing Dyer, is Jack E. Gissler, who has been employed by Lufkin since 1947. He goes to Edmonton from Wichita Falls, Tex., where he has been North Texas district manager for the past 6 years.

Prior to this promotion, Richards was district manager at Oklahoma City for 8 years. Before that, he was district manager at Great Bend, Kans., for 10 years.

Before moving to Canada, Dyer was district manager of both the El Dorado, Ark., and Wichita Falls offices for 1 year each, after having worked in Kansas as service engineer for 2 years. He has been with Lufkin since 1933.

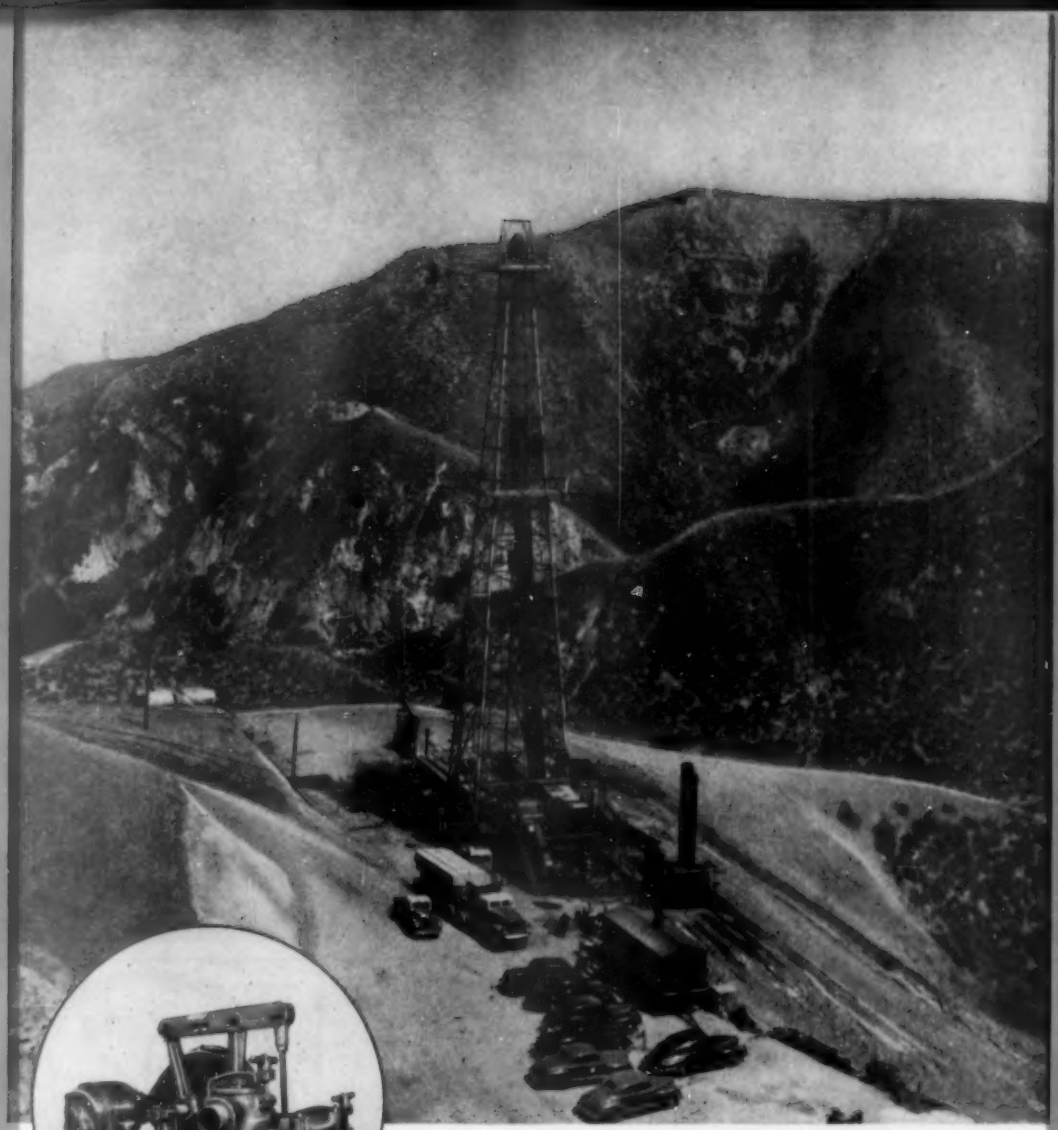
B.J. Services Announces Transfers, Promotions

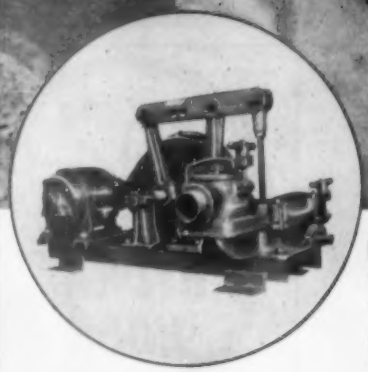
Several new promotions and transfers have been announced by John B. Merritt, of B.J. Service, Inc.

Curtis R. Cross, promoted from district superintendent, Bakersfield, Calif., to Texas division manager, Midland, Tex. Orrie Luttrell, from sales engineer to district superintendent, Bakersfield.

C. W. Ludwig, transferred from sales engineer, Hobbs, N. M., to station superintendent, Hobbs.

R. M. Brazier, promoted from Texas division engineer, to chief development engineer, general office, Long Beach, Calif. E. L. Hughes, from sales engi-





Rugged equipment for rugged country—no matter where the oil is, you'll find dependable Marlow Self-Priming Centrifugal Pumps around the drilling rig. Operators use these job-engineered pumps for rig washdown, brake cooling water, utility water supply and many other applications.

marlows are durable!

Built especially for oil country use, Marlow Self-Priming Pumps and Marlow "Mud Hogs" make a team that can't be beat. Marlows are "old hands" at oil country pumping. They've proved their durability for majors and independents alike on round-the-clock, trouble-free service. That's why more and more veteran oil men are making Marlows first choice. Make sure with Marlow . . . see your Marlow dealer or write for Bulletin O-53.

MARLOW PUMPS • RIDGEWOOD, NEW JERSEY

Division of BELL & GOSSETT COMPANY

LET AVIS TAKE OVER

Close schedules and tight deadlines . . . time is the common denominator in the demanding business of gas and oil. So, step right from your plane into an Avis rent car and *stay* on time!

Only *quality* transportation is available through Avis . . . the very finest in equipment, insurance coverage, personnel and customer service. On your next trip let us reserve a car in advance for your own personal use —anytime, any place. Go AVIS . . . you, too, will be agreeably impressed at everyday low rates.

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are a DEPENDABLE Flame Stop

● These arrestors combine the desired flame stoppage and explosion prevention with minimum pressure drop. Sturdy, rugged semi-steel housings and covers. Corrosion resistant aluminum "banks" have vertical straight through passages, minimizing clogging and simplifying inspection;— extensible for easy cleaning. 2" to 10" sizes. *Write for Bulletin No. 471-R. It gives full details.*

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Here's a good Man to know!

. . . because he can get you all lined up with some of the finest tools ever made for getting wells drilled **right!** ★ Up in North Central Texas, he peddles Web Wilson Tongs, Elevators, Hooks, Links and Power Tubing Spiders—all the BEST of their kind ever made. ★ And when it comes to service, Jerry Moore is your boy, day or night. ★ He gets his mail as G. H. Moore, Box 1347, Wichita Falls, and his telephone is 73-744. ★ Maybe you ought to get together and sort of talk things over—he's available.

neer, Long Beach, to station superintendent at a new station in Sterling, Colo.

George Shell, from service engineer, Tioga, N. D., to sales engineer, Glendive, Mont.

Mission Names Two To Key Management Spots

R. E. WHITE

C. O. BARTLEY

The appointment of Richard E. White as general manager and Charles O. Bartley as works manager of Mission Manufacturing Co., has been announced by Dudley C. Sharp, Mission president.

White has been employed by Mission since his graduation from Texas A. & M. in 1938. He started with the company as a junior engineer and worked up through the engineering and production ranks and was appointed plant superintendent in 1942. In 1946 he was named production manager.

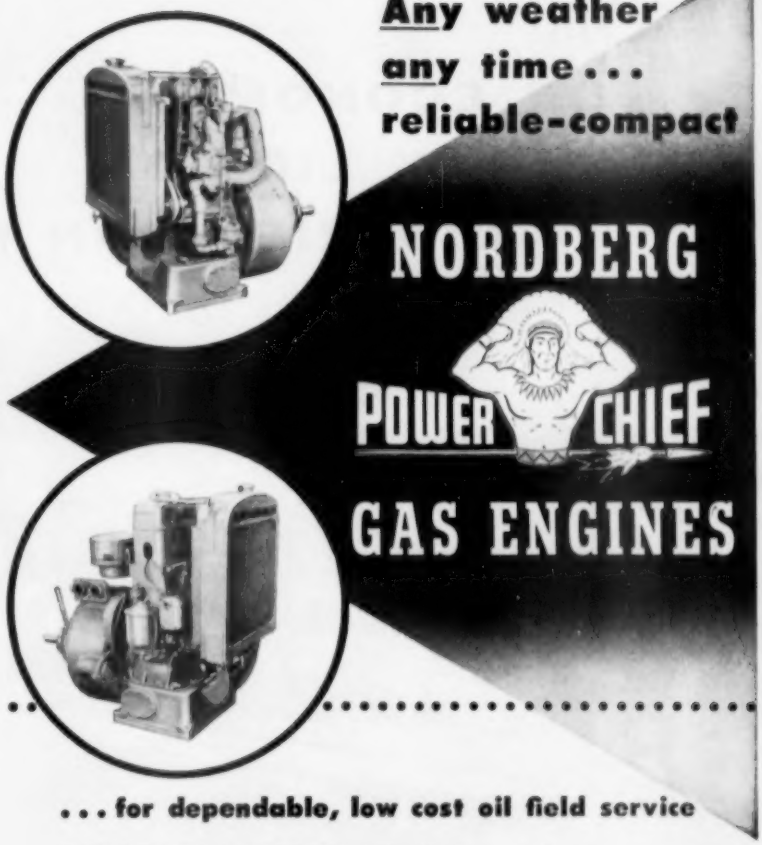
Bartley is also a veteran with Mission. He went to work for the company in 1941. He was employed as a junior engineer and advanced through the ranks to the position of production superintendent in 1949.

B. & W. Shifts Weight to Manage Southwest Sales

G. H. WEIGHT

G. H. Weight has been appointed southwest district sales manager of the Tubular Products Division of The Babcock & Wilcox Co., according to an announcement by J. S. Anderson, general sales manager of the division. Weight has been attached to the Chicago sales office prior to his latest promotion.

Weight joined Babcock & Wilcox in 1926 as a member of the cost department and transferred to the sales department in 1935. From 1942 to 1945 he was associated with the tubing branch of the War Production Board's steel division. He returned to B. & W. in 1946 as a member of the Cleveland



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• NORDBERG *POWER CHIEF* Gas Engines are low cost, medium speed units, built for rugged oil field service. In jobs like production pumping and rig lighting, where 'round-the-clock performance is a must, you'll find these sturdy *POWER CHIEF* units capable of delivering maximum power at minimum operating and maintenance cost—day-in, day-out.

Available as straight power units, delivering 18 hp max., with stub shaft or clutch power take-off . . . and as "packaged" generator sets producing up to 10 kw, Nordberg *POWER CHIEF* Gas Engines are simple to install and easy to maintain. And remember . . . these compact units are backed by the same reputation for dependability as the larger Nordberg Diesel, Gas and Duafuel® Engines used across the nation for efficient pipe line pumping.

Mail the coupon for full details.

Nordberg Mfg. Co., Milwaukee, Wisconsin

THERE IS A NORDBERG DISTRIBUTOR TO SERVE YOU IN ALL PRINCIPAL CITIES

NORDBERG

Builders of America's Largest Line of Heavy Duty Diesels

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Aerial view of Carteret, N. J. terminal

If you deal in any liquid that flows through a pipeline, take advantage of the market coverage offered by General American. You can use these terminals in five important marketing and producing areas for economical distribution of your bulk liquids.

Important consideration: you can lease General American's tank storage facilities *as you need them;* without capital investment on your part.

See General American for particulars about bulk liquid storage.

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a division of GENERAL AMERICAN TRANSPORTATION CORPORATION
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HAS A GEAR TRAIN BUILT FOR LONG, SUSTAINED PULLS

THE GEAR TRAIN of the Carco GO winch is engineered for the long, sustained pulls found in oil field and pipeline work. As a result, you can pull with a Carco GO winch for indefinite periods without the gear train producing excess heat. This is only one of the reasons why Carco GO winches are giving such outstanding performances for pipeliners and oil field operators. Another and even more vital reason is that the Carco GO winch was specifically designed for oil field and pipeline work. That's why it's built with large drum capacity, automatic brake and two speeds forward and two reverse. One slow-speed for the long, sustained pulls and another for lighter winching jobs. Roller type fairlead is easily attached. See your nearest Carco dealer. PACIFIC CAR AND FOUNDRY COMPANY, Renton, Washington. Branches at Portland, Oregon, and Franklin Park, Illinois.

WINCHES
For All Industrial Tractors
CARCO

district sales force, and was transferred to Chicago the following year.

In his new position, Weight will have charge of the division's sales offices in Houston and Tulsa, and will supervise the sale of the company's seamless and welded steel tubular products in the area. His territory will include the states of Texas, Oklahoma, Arkansas Mississippi, Louisiana, and southern Kansas.

Dervey is General Sales Manager of American Hoist

R. J. DERVEY

Ray J. Dervey has been appointed general sales manager of American Hoist & Derrick Co., St. Paul, Minn., according to John E. Carroll, president.

Dervey started his industrial career as a production engineer for United States Steel Co. Joining American Hoist in 1945, Dervey worked in the industrial equipment division at the St. Paul sales office. He was promoted to district manager in 1946, at which time he took charge of the Pittsburgh office and territory.

Dervey fills the post formerly held by John Carroll, now president of the firm.

Cottrell Joins Flow Measurement Co., Inc.

J. L. COTTRELL

J. L. Cottrell, associated with Rockwell Manufacturing Co. for more than 20 years, recently resigned the position of sales manager of the Instrument Division to become president of Flow Measurement Co., Inc., Tulsa. The new firm will do gas measurement consulting and will be factory representatives for metering and regulating equipment.

Cottrell's firm represents Chaplin-Fulton Manufacturing Co., Pittsburgh, in the Mid-Continent area, handling gas regulators, safety valves, and other products.

Other companies represented by Flow Measurement Co. are American Recording Chart Co., Weksler Thermometer Corp., New York, and Moorlane Co., Tulsa.

Al Schawalder, vice president of the firm is in charge of the instrument manufacture and repair. Schawalder's

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Instead of writing a letter to each of those Advertisers, remove one of the cards from the yellow page you'll find in this issue—keep it beside you as you go through this issue.

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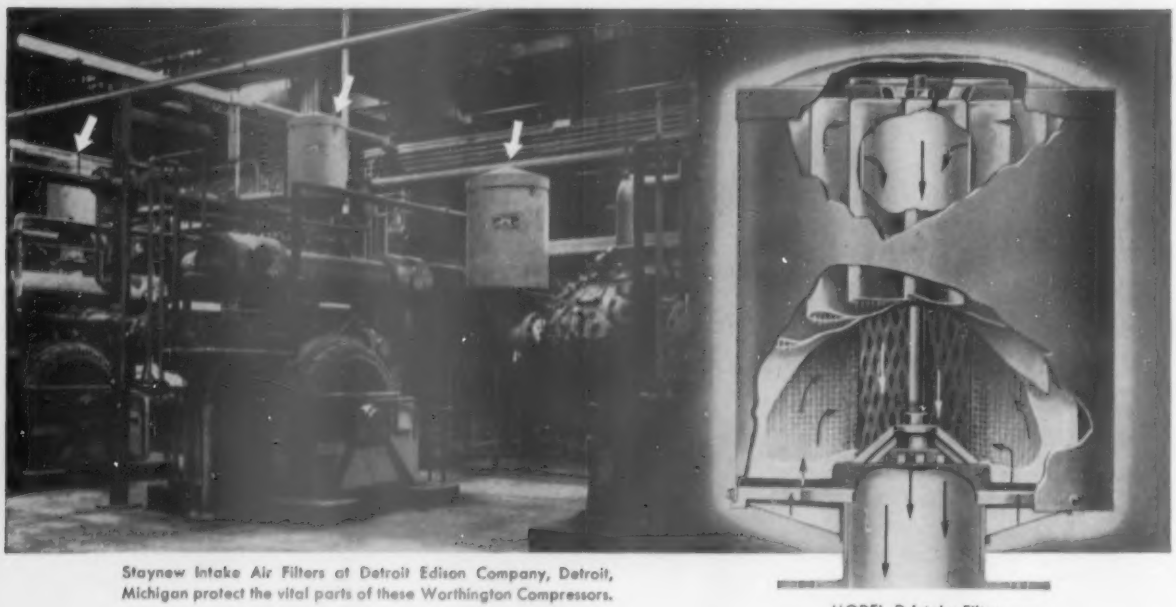
STAYNEW INTAKE FILTERS



Staynew Intake Air Filters at Detroit Edison Company, Detroit, Michigan protect the vital parts of these Worthington Compressors.

MODEL D Intake Filter

KEEP COMPRESSORS YOUNG!

Your air compressing equipment demands the protection Staynew Intake Filters are designed to give. With Staynew, compressors, and internal combustion engines, blowers, motors and generators remain at peak efficiency years longer.

Staynew's "Positive Protection" keeps shutdowns and repairs at an absolute minimum. And Staynew itself requires less attention. The *dry-type* filtering medium has the ability to remove air-borne dust particles without the necessity of viscous filter aids.

Staynew Intake Filters efficiently protect vital engine parts without carefully held maintenance schedules. And where noise is a problem, Model DS Silencer Filters are available. To keep equipment young, always specify Staynew.

Write today for Staynew Catalog S.I.F.

Representatives in Principal Cities

- Positive Protection
- Efficiency Actually Increases with Use
- Efficient Over a Wide Range of Loads
- Not Affected by Temperature Changes
- No Oil Carry-Over
- No Oil Blow-Out Over Free Air-Unloading Compressors

DOLLINGER PROTECTOMOTOR STAYNEW FILTERS

DOLLINGER CORPORATION

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ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED

entire career has been devoted to instrument design and manufacture.

Cottrell spent 7 years in operations with Union Gas System, Inc., Independence, Kans., before entering the manufacturing business. He is co-inventor of the McGaughey integrator.

Orbit Makes Sales Shifts In Texas and Oklahoma

Two major changes in sales personnel have been announced by J. Dock Mumford, vice president of Orbit Valve Co.

James P. Bowling is being transferred from Lafayette, La., to Dallas, from

J. P. BOWLING

G. LASTRAPES

where he will service North Texas, East Texas, and Fort Worth, as well as the local area. Bowling has been with Orbit since 1952.

Gil Lastrapes, Jr., has been appointed to service the South Louisiana area and will make his headquarters at Lafayette. Before joining Orbit, Lastrapes was associated with Camco and also with Rector Well Equipment Co. in South Louisiana.

Gray Appointed to Key McCullough Position

J. M. GRAY

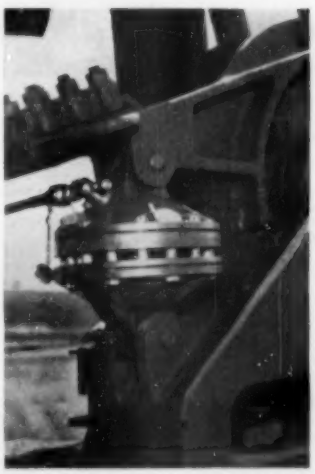
James M. Gray has been appointed assistant vice president of McCullough Tool Co., according to I. J. McCullough, president. Gray will remain in Houston, where he will assist in the administration of the eastern division of the company which is under the direction of O. J. McCullough, vice president.

For 10 years prior to joining McCullough in 1939 as eastern division credit manager, Gray was associated with National City Bank in New York City. Previous to that he had been with Boone County National Bank, Columbia, Mo., and First Trust & Savings Bank, Miami, Fla.

In 1950, Gray was appointed assistant secretary-treasurer of McCullough Tool, and in 1952 became a member

THIS IS THE LAST WORD IN WEIGHT-INDICATOR ACCURACY

Martin-Decker's new Sensater gives you friction-free weight indication



The E-80 Sensater is a new kind of *diaphragm* pressure transformer. It doesn't deflect, but moves with its backing plate. The slightest movement of your Ideal Wire Line Anchor creates a piston-like stroke, without a friction-causing piston-rod or packing.

With the new ultra-perceptive Sensater, your Martin-Decker Type "D" or "E" Weight Indicator becomes a more valuable tool than ever for such precision jobs as fishing, milling, cutting, and coring — a small investment to increase the life of diamond bits and other costly equipment making up a half-million-dollar drilling rig.

The big color-keyed indicator dial instantly tells you the accurate weight of the drill string and the net weight on bit in thousands of pounds. Included is a vernier, sensitive to minor weight changes.

Martin-Decker's familiar red box is packed with valuable drilling information. The instrument panel includes a weight indicator, mud-pressure gauge, rotary torque gauge, draw-works speed selector, rotary-table tachometer, and a vapor-proof light. On the back is a 24-hour recorder with pens for weight, mud, and torque. Martin-Decker engineers will work out other instrument combinations for your special drilling requirements.

For further information ask for Bulletin P-10. Write: Martin-Decker, 3431 Cherry Ave., Long Beach 7, California, Dept. D-1.

DISTRIBUTORS: T. C. Cullen, Bakersfield, California; Reed Roller Bit Co., Houston, Texas; Reed Roller Bit Co. of Canada, Ltd., Calgary and Edmonton, Alberta. Martin-Decker Weight Indicators and Ideal Wire Line Anchors are also sold through The National Supply Co., The National Supply Co. Export Division and other recognized supply houses.

MARTIN-DECKER CORP.

HOME OF THE WEIGHT INDICATOR — LONG BEACH, CALIFORNIA

VICTAULIC
METHOD OF PIPING

FOR GROOVED PIPE

Style 78
VICTAULIC SNAP-JOINT

New, boltless coupling — hand-locks — for faster hook-ups with no loose parts. Ideal for temporary or permanent lines. Sizes 1", 1¼", 2", 3", 4".

Style 77 & 77-D

VICTAULIC COUPLINGS Style 75

Style 77 & 77-D—The "general-purpose" couplings for standard applications. Simple, fast, reliable—sizes ¾" to 60".

Style 75—Light Weight Couplings—for low pressure, low external stress applications. Sizes 2", 3", 4".

VIC-GROOVER TOOLS

Handy, on-the-job grooving tools that do the work in half the time. Light weight, easy to handle, operate manually or from any power drive. Automatic groove position and depth. Sizes ¾" to 8".

VICTAULIC FULL-FLOW FITTINGS

Streamlined for top efficiency, easy to install—complete line, Elbows, Tees, Reducers, Laterals, etc., — fit all Victaulic Couplings. Sizes ¾" to 12".

FOR PLAIN END PIPE

Style 99
VICTAULIC ROUST-A-BOUT COUPLINGS Best engineered, most useful plain end joint on the market! Simple, fast, husky. Easy to install with any socket wrench. Takes strong, positive, bull-dog grip on pipe. Sizes 2" to 8".

Promptly available from distributor stocks coast-to-coast. Write for NEW Victaulic Catalog and Engineering Manual No. 54-OF.

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P. O. Box 509 • Elizabeth, N. J.

EASIEST WAY TO MAKE ENDS MEET!

of McCullough advisory committee, profit sharing and stock ownership plan.

Schlumberger Announces Personnel Changes

A number of field personnel changes have been announced by Schlumberger Well Surveying Corp.

W. J. Hickman, who has been field engineer at Tyler, Tex., has been transferred to Electra, Tex., as engineer-in-charge.

J. E. Stroop, field engineer at Electra, has been transferred to Coleman, Tex., as location manager. He succeeds H. B. Baskette, who has gone to Gainesville, Tex., as location manager.

Calvin A. Smethie has been sent to Haskell, Okla., as location manager. He was formerly field engineer at Graham, Tex.

Morgan, Ohlsen Added to Engineering & Sales Staff

George W. Morgan and Norman H. Ohlsen have been added to the corrosion mitigation sales force of Plastic Engineering & Sales Corp. Both men will shortly move to their respective territories which will be the lower Gulf Coast of Texas for Morgan, and the State of Oklahoma for Ohlsen.

Morgan was formerly with Hughes Tool Co., Houston, in the manufacturing department. Ohlsen was formerly with Texas Bitulithic Co., Dallas.

Sobel, Kopelman Form Oil Field Supply Co.

S. Laurence Sobel and Martin R. Kopelman announce the formation of a partnership to be known as Oil Field Supply Co. with offices in the Kennedy Building, Tulsa.

Oil Field Supply Co. sells oil-field supplies and equipment with special emphasis on new tubular goods and new tanks in accordance with A.P.I. specifications. Special sizes of tanks will be fabricated on order to meet with individual requirements.

Fluid Packed Pump Acquires Subsurface Tool Rights

A joint statement issued by J. B. Reilly, president of Fluid Packed Pump Co., and Ward Poulson, president of Knowlton Oil Tool Co., announces the acquisition from the Knowlton Tool Co. of the rights to manufacture subsurface tools using the Knowlton vertical-setting mechanism. During the interim period while Fluid Packed Pump Co. is tooling for production, the Knowlton Oil Tool

Continental Drilling Company officials, pictured left to right, are: Marshall A. Smith, Sr., V.P.; Baker R. Littlefield, Pres.; J. O. Sharon, Drilling Supt.; Marshall A. Smith, Jr., Secy. and Gen. Mgr.

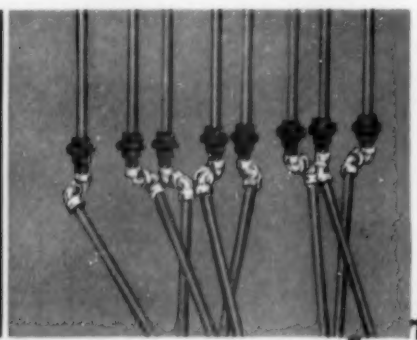
"We Use GUIBERSON SEAL-O-MATIC UNIONS Exclusively on our Workover Barge No. 7"

So states Mr. Baker R. Littlefield of Continental Drilling Company, New Orleans. Workover barge No. 7, shown here, is capable of handling 12,500 feet of 3½" drill pipe and of handling any workover in the Gulf Coast area.

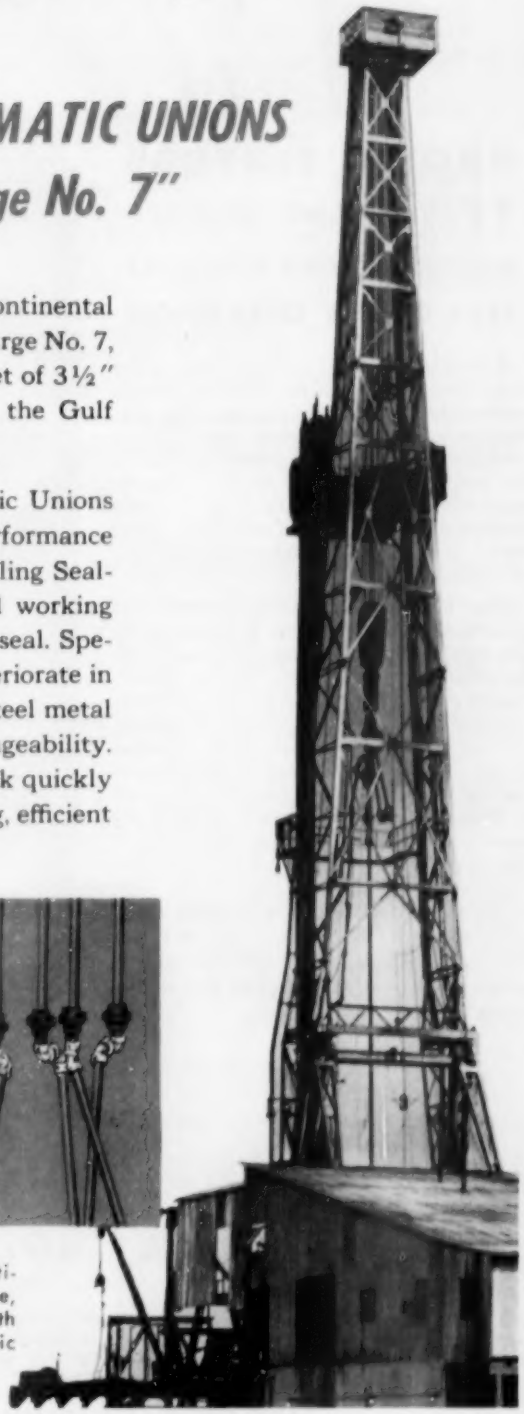
Exclusive use of Guiberson Seal-O-Matic Unions for this heavy duty service is proof of their performance under the severest conditions. The double-sealing Seal-O-Matic Ring and metal to metal seat hold working pressures securely — give positive leak-proof seal. Special oil resistant Seal-O-Matic Ring won't deteriorate in oil, gas or under pressure. High tensile alloy steel metal parts are precision machined to assure changeability. Guiberson Seal-O-Matic Unions make or break quickly and easily, require minimum upkeep, give long, efficient service.

Guiberson Seal-O-Matic Union

Available in four pressure ratings, 4,000 p.s.i., 6,000 p.s.i., 10,000 p.s.i., and 15,000 p.s.i., in wing or Hex nut styles with 3 types of threads in 7 sizes—1" through 4".

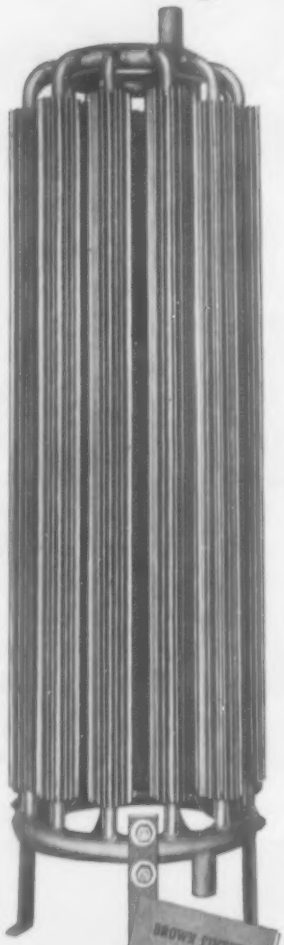


Manifold Bank on Continental Workover Barge, equipped exclusively with Guiberson Seal-O-Matic Unions.



Vertical Mounting of

BROWN FINTUBE TF-18 TANK HEATERS ASSURES MORE EFFICIENT LESS COSTLY OPERATION



● Mounted on legs 10 inches above the tank floor, our TF-18 Heaters are entirely surrounded by the tank liquids. This prevents sediment from settling on the heating surfaces as when an old-fashioned coil in the bottom of the tank is used . . . assures more efficient, less costly heating . . . avoids heating through a layer of sediment . . . and leaves the tank floor uncluttered and easy to clean.

The finned construction provides approximately 7 times more heating surface per foot of tube length than plain bare pipe or tubing. Consequently, TF-18 Heaters transfer **more heat,** faster and at lower temperatures, avoiding coking or damage to heat sensitive materials. Easily installed in existing or new tanks. TF-18 Heaters **do not** require welding inside the tank. Tried, re-ordered and widely used by the country's leading petroleum and chemical concerns.

You can't keep your operations competitive with old fashioned, obsolete methods. Write today. Get full details about these new, fully proved, less costly, more efficient tank heaters.

New fully descriptive Bulletin No. 541 gives dimensions and full details. Write for your copy today.

Brown Fintube Co. *Elyria, Ohio*

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CHICAGO • ST. PAUL • ST. LOUIS • KANSAS CITY • MEMPHIS • BIRMINGHAM • NEW ORLEANS
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FRIEDRICH UHDE, GMBH, DORTMUND, GERMANY

Co. will continue to manufacture and service its products. By virtue of this purchase, Fluid Packed Pump will manufatcure and market a complete line of packers, tubing anchors, liner hangers, and insert-pump anchors.

American Manufacturing Makes Republic Distributor

John J. Pike, president of The Republic Supply Co., Calif., announces that the firm has assumed the exclusive distributorship in California for the pumping-unit line of American Manufacturing Co., located at Fort Worth.

American Manufacturing has been constantly developing this line of pumping units for the petroleum industry, and now makes a full range of A.P.I. sizes. Republic Supply is carrying the complete line and will stock parts and render service.

Formation of Jet-Lube of Canada, Ltd., is Announced

Jet-Lube, Inc., of California, developers of oil-field lubricants compounded with molybdenum disulphide, has completed negotiations for the establishment of a Canadian plant to manufacture the entire line of products, according to an announcement by Jack C. Ballagh, president.

Under exclusive license, Jet Lube of Canada, Ltd., an Edmonton corporation, will produce and distribute Jet-Lube oil-field and industrial lubricants throughout the dominion.

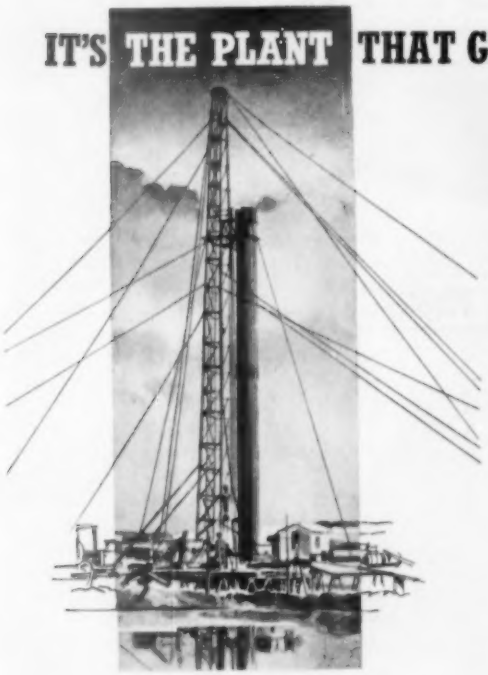
H. E. Snelson, president of United Drilling Services, Ltd., is the managing director and vice president of the new organization. Other officers and directors are: W. L. Falkner, president; J. F. Langston, secretary-treasurer; and W. F. Knode, director.

The new plant is being assembled in Los Angeles and is expected to be erected and in operation in September.

H. E. Snelson, (left), vice president and managing director of the newly formed Jet-Lube of Canada, Ltd., is shown with Jack C. Ballagh, (center), and Frank Bergeron, (right), executives of Jet-Lube, Inc., Los Angeles.

IT'S THE PLANT THAT GETS THE OIL THAT TURNS THE WHEELS

— BE SURE OF *YOUR* PLANT —



One of the great indispensables of oil-winning is Steel Wire Rope, and we manufacture it with just such tough conditions as yours in mind.

We supply to B.S.I., A.P.I., Lloyd's and all other recognised requirements, but we shall also be glad to quote to any other specifications for your special needs.

We have been making Ropes and Canvas for over 200 years now, and by giving quality and service have earned our world-wide reputation for first class products.

Our 92-page Booklet (Ref.) 0.3/1. on the "Hows and Whats" of Steel Wire Rope is available Free on request.

IF IT'S GOUROCK IT'S GOT GUTS

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EXPLORATION

Queen Discoveries Arouse West Texas

by Frank J. Gardner

A SIGNIFICANT but little-heralded development has occurred in one-two-three fashion out in Andrews County, Texas, since August 5. Its significance is not immediately apparent without a bit of map study and log analysis, but it could lead to a reappraisal of many old West Texas fields and a consequent upward revision of their reserve figures.

How it happened . . . On July 27, two tests were spudded on the west and northwest flanks of the old Means field which were destined to bring about an interesting new campaign across the field proper. Vests, Dorbandt & Ross started their 1 McQuatters Tr. "B" (small stippled circle on map at north end of field) on the same day that Humble reentered its 134 J. S. Means, a failure abandoned in 1952. Nine days later, after perforating and fracturing the Queen sand at 4,024-36 ft. and 4,044-64 ft., Humble put its old dry hole on production for 380 bbl. per day through a ½-in. choke. On August 13, Vests et al finished the 1 McQuatters "B" well for 361 bbl. daily from the Queen at 4,175-91 ft.

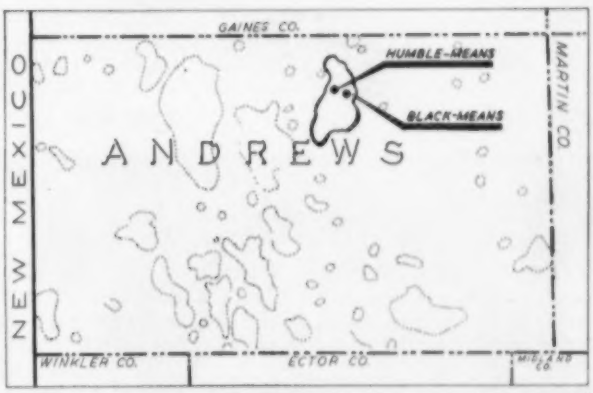
Immediately, the possibilities of flush Queen sand production over at least the northern half of the field became apparent; how many wells had cased off the formation in the early days of development? How many flanking failures might yet be placed on production?

Another independent, W. H. Black, enhanced the potent promise of the Queen on September 7 as he finished his 1-A J. S. Means Estate for a whopping 711 bbl. per day on a ⅜-in. choke at the 4,020-ft. level. This was a 1½-mile stride eastward across the waist of the field, and emphasized the potentialities of "up-the-hole" reworks in older field wells.

First oil on east side . . . But even more important is the fact that this is the first Queen sand production in the great stretch of territory lying between East Hobbs field of New Mexico, along the eastern edge of (and extending to the southern extremity of) the Central Basin Platform (see bottom map).

Top right: Two good discoveries within Means field area have revealed flush potentialities of Queen sand.

Lower right: Queen sand discoveries at Means are far removed from previous production from the formation. Older Queen production is shown in black.



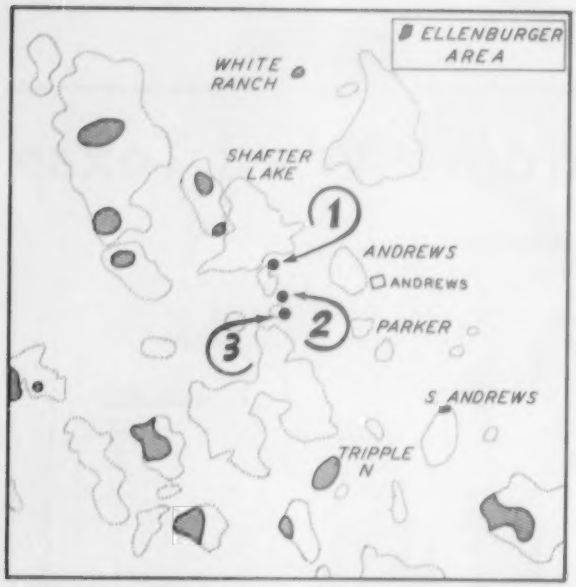
The Queen is a blanket formation over the entire Permian basin area, and production from its sandy phases has long been established on the eastern shelf of the basin, and in two fields out in the middle (see map). It produces oil all along the western margin of the platform from Pecos and Crockett counties as far north as Caprock field in New Mexico; the sands have been locally named the Shipley, Colby, Penrose, Shugart, Walker, etc. in Texas, and the Red sand in New Mexico. The name Queen was originally taken from extensive exposures in the vicinity of Queen post office in New Mexico.

Means may set example . . . Means field was discovered in August 1934 by Humble Oil & Refining Co. 1 R. M. Means after an extensive seismic, surface, and subsurface investigation. In the 20 years since then, from the combined efforts of some 14 operators, a 10,000-acre field has evolved. Its 248 producing wells have accounted for about 23 million barrels of oil produced.

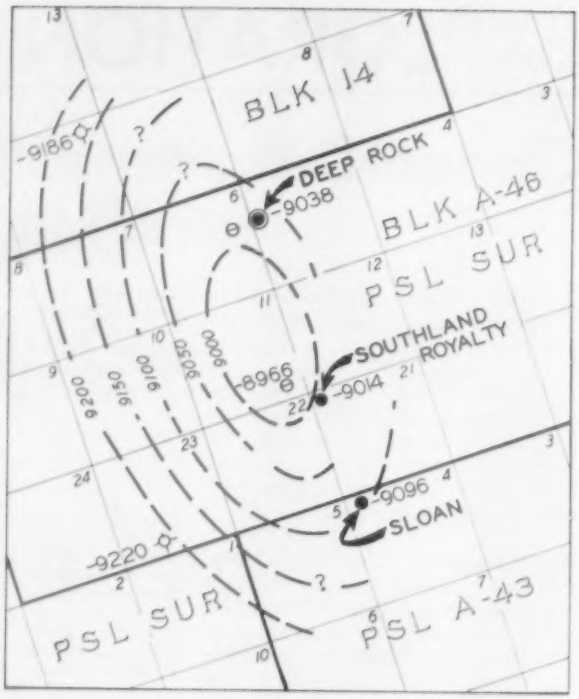
The oil has come from two reservoirs: the lower Grayburg dolomite section at 4,250 to 4,312 ft. and the upper San Andres lime section at 4,326 to 4,536 ft. (average field elevation 3,156 ft.). The two appear to have a common water table, with the San Andres production centering on the east side of the field, and the Grayburg oil on the west; where both pays are present, operators are permitted to produce them together.

Structurally, the field lies on a broad, flat anticline, but production has been found to be controlled by porosity changes and feather-outs more than by structural influences. A couple of wells were completed as gas producers from Yates sand at the 2,900-ft. level, but the shallower formations of the Whitehorse group had never before yielded profitable reservoirs.

There must be numbers of old Permian fields in which its possibilities were overlooked in the concentrated search for San Andres oil during the twenties and thirties, all along this eastern platform edge. New completion practices, new testing methods, and new drilling procedures are making oil wells where none could have been made in the old days. Our new reserves depend in great degree upon the "extensions and revisions" categories that appear in every reserve tabulation, and it is just such developments as these that go to make up those all-important figures on reserves.



RELATIVE LOCATION (above) of new Deep Rock-Ellenburger field in central Andrews County, with strikes numbered in order of completion.



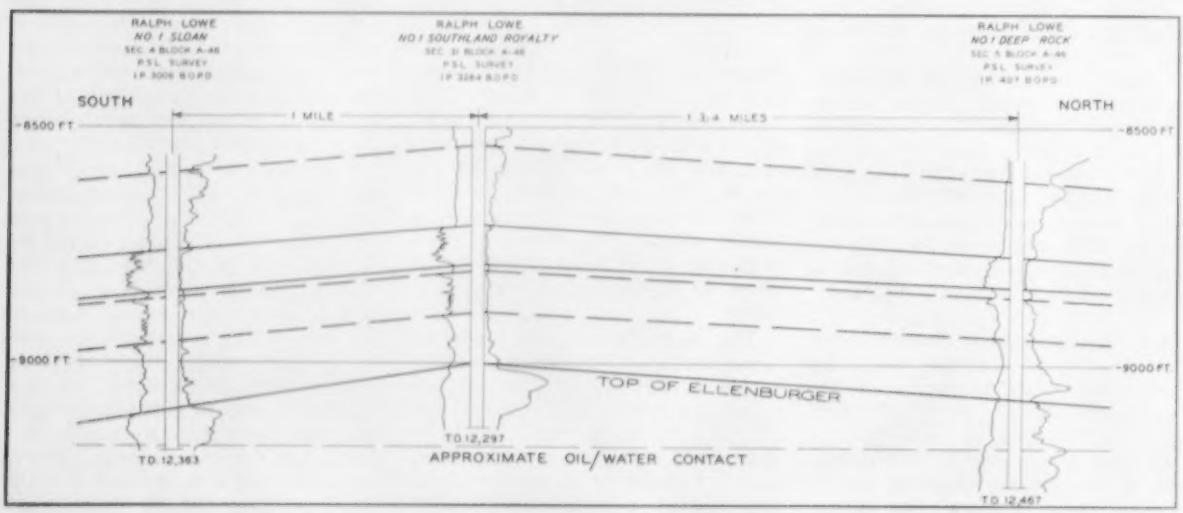
PRELIMINARY Ellenburger contouring (right) indicates a large structure.

Three Strikes Open Ellenburger Field

by Carl Hoot

RALPH LOWE'S three strikes in what was previously a shallow producing area of central Andrews County, West Texas, have opened an Ellenburger producing structure of major possibilities. The wells were drilled and completed in one-two-three fashion, all flush producers, and all having 100 ft. or more of pay above water level.

The structure map here has been contoured on the Ellenburger. Shaded portions show the relative position of Permian production limits. It will be noted that few exploratory wells within the immediate area have been drilled to the Ellenburger, to offer control on the deep formations. At one control point the Ellenburger top has been estimated since the well was not carried to that formation, probably because it was running low.



North-south cross-section of the new pool shows good Ellenburger section above water.

Strike one . . . Drilling started on the first test in August, 1953. This was designated Ralph Lowe 1 Deep Rock, and was located in Section 5, Block A-46, PSL Survey, 5 miles northwest of Andrews. It was carefully logged all the way down and oil shows were reported in the San Andres, Glorieta and Clear Fork sections.

Top of the Ellenburger was found at 12,244 ft., minus datum point of 9,038 ft. This top looked high enough above the control point to the northwest, drilled by Cities Service and Sinclair, to give a good Ellenburger section above the water.

First drill-stem test of the Ellenburger in 1 Deep Rock was made at 12,223-274 ft., and had flowing oil in 2 hours and 45 minutes. There was no formation water when pipe was pulled. A subsequent test, at 12,385-12,479 ft. developed sulfur water with no shows of oil or gas. The well was then plugged back and completed from perforated interval at 12,252-278 ft. Potential was 407 bbl. daily through 14/64-in. choke. Tubing pressure was 660 psi., gas-oil ratio was 480 cu. ft. and gravity was 43.8°.

Strike two . . . The company's second test, 1 Southland Royalty Co., was put down nearly 2 miles to the south of the discovery, in Section 21. This well found the Ellenburger, and pay top, 24 ft. higher than the first well, at minus 9,014 ft. Flowing through ¾-in. choke, it made 3,264 bbl. daily on completion test. Gravity was the same as the first one at 43.8°, and gas-oil ratio was 400 cu. ft.

Strike three . . . Ralph Lowe 1 Sloan, Section 4, A-43, was drilled 1 mile south of 1 Southland Royalty. It was expected, and proved to be, low on structure at minus 9,096 ft., but proved approximately 100 ft. of pay section and supported the operator's belief that he had drilled on structure.

No. 1 Sloan was successfully completed without drilling to the water table. Potential was 3,006 bbl. of oil a day, gravity 43.8°, gas-oil ratio 370 cu. ft. and flowing tubing pressure 475 psi. Top of pay was 12,260 ft. and total depth was 12,368 ft.

Structural Considerations

Drilling of the two successive strikes immediately following the original discovery may be attributed to several factors, and argued as to whether or not it was smart geology, good business, or a mixture of each. Location of the first test probably was on the basis of expiring leases, but acreage to the south of it apparently was picked up at a later date.

The broad and flat Ellenburger anticlinal structure now indicated by the three discoveries would offer a poor shooting picture. The operator had a control point to the northwest within reasonable distance, but the same point to the south was nearly 7 miles distant. Water level of around minus 9,200 ft. in Ralph Lowe 1 Deep Rock checks with the dry hole control point in Section 12, which had the Ellenburger at minus 9,186 ft. That contour line is also supported by the estimated top of minus 9,220 ft. in the failure drilled in Section 23, to the west of the southernmost producing well.

At this writing, development drilling consists of close-in offsets. Closure on the eastern side of the structure is indicated; all the facts point to a possible 6-section development, or 100 Ellenburger wells.

Many of the Ellenburger fields in Andrews County have active water drives and as a consequence, the ultimate recovery from these fields is large on a barrel-per-acre-foot basis.

A north-south cross-section through Deep Rock-Ellenburger field shows the anticlinal nature of the reservoir with over 200 ft. of oil column above the estimated oil-water contact.

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KANSAS

Committee Names New Pools In Fourteen Kansas Counties

A big new list of recent pool openers has been announced by the Nomenclature Committee of the Mid-Continent Oil & Gas Association in Kansas. Twenty new oil and gas producing areas have been named.

Southern Kansas . . . Barber County has two new pools, Southwest Whelan and Little Bear Creek. The first was opened by Harms-Burt at 1 Smith, NW NW NW 11-32s-12w, as a Mississippian producer. The latter was opened by Purcell & Mull 1 Lake, NW SW NW 12-32s-14w, as a Pennsylvanian Douglas sand producer.

Sumner County has a new producer at Eash Ashton pool, opened by Capitt Drilling Co. 1 Schifferdecker, SE SE NE 20-34s-2e, with Mississippian production.

Northwest Kansas . . . On the northwestern flank of the Central Kansas uplift in Decatur County Sauvage and Dunn 1 Pollnow, NW NW SE 31-2s-20w, is completing in the Lansing to open Northwest Pollnow pool.

Central uplift area . . . On the southwestern flank of the uplift in Edwards County Sturgeon pool was opened by GMR Oil Co. 1 Sturgeon, SE SE SW 33-26s-18w, with Viola production.

Veeder Supply Co. 1 Irvin, NW NW NW 11-11s-20w, a Lansing discovery, has revived Eagle Creek pool in Ellis County. Northeast Schmied pool was opened by Wentworth Drilling Co. at 1 Walts, SW SW SW 10-8s-25w, in Graham County with Lansing pay.

Also opened in Graham was Van Pool at N.C.R.A. 2 Van Loenen, NE NE NE 14-9s-22w, with Arbuckle production. Pawnee County has three new pools. Northeast Garfield, opened by Knight Drilling Co. and N.C.R.A. at 1 Hutchinson estate, NW NW NW 30-23s-17w, as a Mississippian producer; Jay pool, opened by Atlantic Refining Co. 1 Smith, NW NW SW 3-23s-15w, as a Simpson producer; and East Shiley pool, opened by N.C.R.A. 1 Ekert, NW NW NW 18-20s-19w, as a Cherokee producer.

Rooks County on the uplift has two new pools; Southeast Dopita, opened by Murfin Drilling Co. 1 Kike, NW NW SE 5-9s-17w, as a Lansing producer, and Nutsch pool, opened by Francis Oil & Gas Co. 1 Nutsch "B," C S½ S½ 3-10s-20w, finaled for 433 bbl. of Arbuckle oil per day.

In Rice County, Lario Oil & Gas Co. 1 Shonyo, SW SW SE 11-18s-10w, an Arbuckle discovery, opened Bushton pool. Stafford County has two new pools, North Kipp and Kennill. North Kipp was opened at Deep Rock Oil Corp. 1 Tanner, NE SW NW 23-25s-14w, as a Lansing producer. Welch and Olsson 1 Green opened the latter pool in NW NW SE 4-23s-13w, with Arbuckle production. Trego County has a new pool at East Hixson, opened at Stanolind Oil & Gas Co. 1 Scott, NW SW SW 16-11s-22w, with Arbuckle production.

Eastern Kansas . . . White and Ellis 1 Curry, NW NW NE 5-22s-11e, Greenwood County, opened Ly-Green pool with Bartlesville sand production.

Sedgwick basin . . . The Sedgwick basin of south-central Kansas has two new pools. In Harper County Anthony pool was opened at Gulf Oil Corp. 1 Rife, SW NE SW 31-33s-6w. It is a gas producer with Mississippian production.

Kingman County has a new area at Northwest Spivey pool, opened by Petroleum, Inc. 1 Evans "A," SE SW SE 9-30s-8w. It gaged 3,500 M.c.f. of gas per day from the Mississippian.

Pawnee County Gets Another Gas Strike

A gas pool discovery or Garfield pool extension is reported at Sunray Oil Corp. and Hilton Drilling Co. 1 Fergus, NW NW SW 16-23s-17w, ¾ mile northeast of Garfield pool.

Gas gaged 4,500 M.c.f. on drill-stem test in the cherty conglomerate at 4,227-38 ft. A Mississippian test at 4,252-81 ft. recovered 150 ft. slightly oil and gas-cut mud.

Gas Discovery Hinted In Southern Barber Area

Aurora Gasoline Co. and Barbour Drilling Co. tested good Mississippian gas shows at 1 Rathgeber, C NE SE 31-34s-12w, 7½ miles south of Boggs pool.

The rank wildcat gaged 6,800 M.c.f. of gas per day on drill-stem test at 4,797-4,825 ft. in the Mississippian.

Graham County Discovery Waiting On Potential Test

Wentworth Drilling Co. 1 Walts, SW SW SW 10-8s-25w, 1 mile northeast of Schmied pool, flowed 14 bbl. of oil per hour on test of Lansing perforations at 3,867-72 ft.

The operator is waiting on potential test. Gravity of the oil is 46.5.

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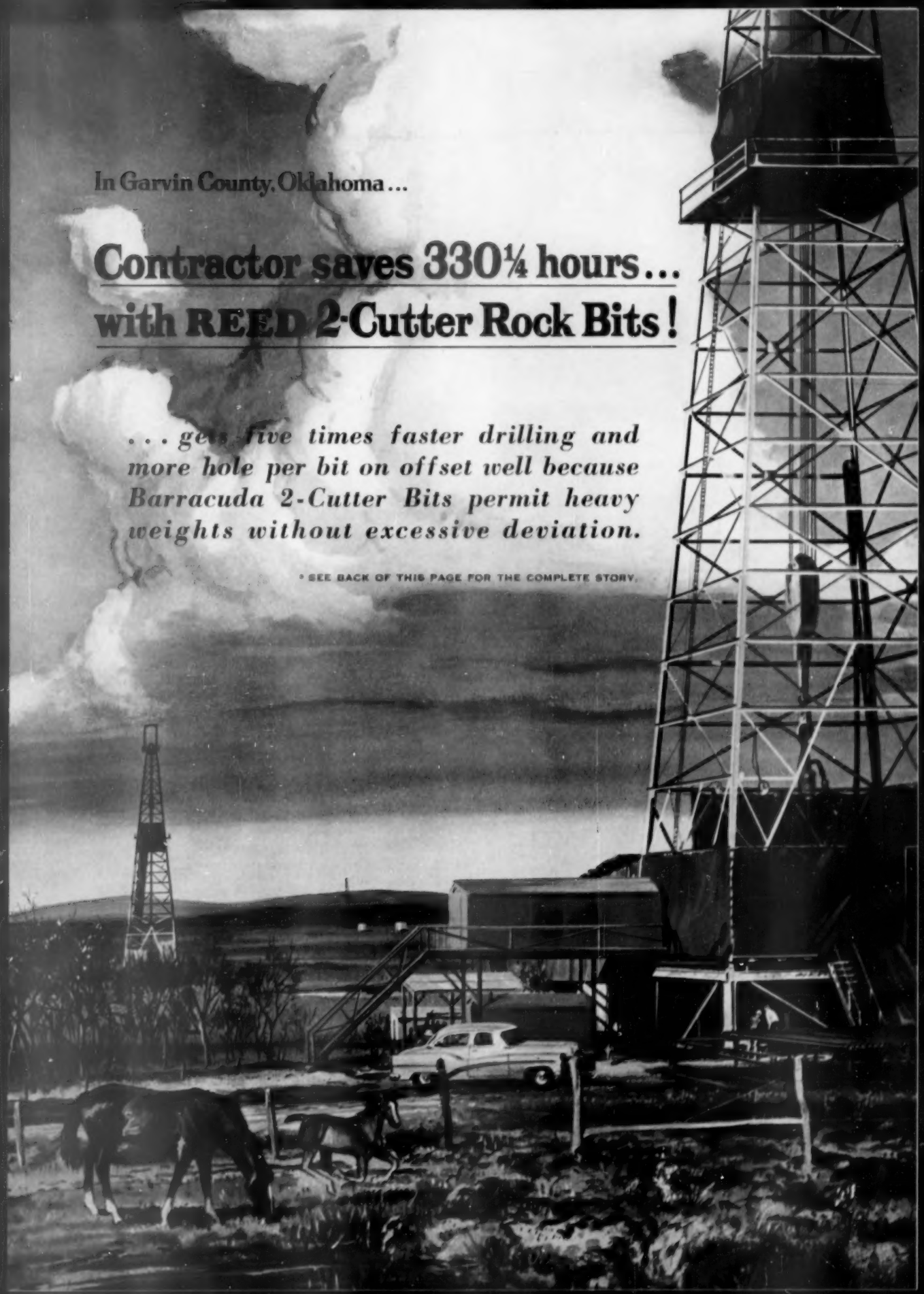
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Contractor saves 330¼ hours...
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...gets five times faster drilling and more hole per bit on offset well because Barracuda 2-Cutter Bits permit heavy weights without excessive deviation.
* SEE BACK OF THIS PAGE FOR THE COMPLETE STORY.

REED Barracuda 2-Cutter **ROCK BITS**

DEPTH OF HOLE	FOOTAGE EACH BIT	HOURS BIT RUN	WT. ON BIT IN 1000 LBS	DEVIATION
8798			35	1½°
8889	91	13	40	¾°
8940	51	5	40/60	¾°
9017	77	9	35	2°
9171	154	16½	40/60	1¾°
9252	81	10	35	2¾°
9301	49	9	35	2½°
9339	38	6¼	36	2½°
9382	43	10	25	1¾°
9393	11	2½		1¾°
TOTAL	595 feet	81¼ hours		

CONVENTIONAL BITS

DEPTH OF HOLE	FOOTAGE EACH BIT	HOURS BIT RUN	WT. ON BIT IN 1000 LBS	DEVIATION
8765				7°
8832	67	29	10	8°
8900	68	31	10	8°
9047	147	45	10	8°
9144	97	43		
9174	30	37		
9200	26	26		
9276	76	48		
9303	27	32		
9325	22	22		
9337	12	16½		
9359	13	24		
9378	28	36		
9401	23	22		
TOTAL	636 feet	411¾ hours		

Contractor saves 330¼ hours... with REED 2-Cutter Rock Bits!

THE TRIGG DRILLING COMPANY, drilling two offset wells in Garvin County, Oklahoma, for a major oil company, made competitive runs between 8700 and 9400 feet.

On one well they used conventional bits and on the other they used the new **REED** Barracuda Twin-Blast 2-Cutter Bits.

Formations were Springer Shale, Base Springer, Caney Top and Woodford. Both rigs had 7¾ x 18 pumps with 6½" liners, and both used 9" bits.

Here's what happened:

On the well using conventional bits, drilling weights were about 10,000 pounds and deviations reached 8 degrees. Rate of penetration averaged only 1.54 feet per hour and 13 bits were used to drill 636 feet.

With **REED** *Barracuda Bits, weights of from 35,000 to 60,000 pounds were used and deviations never exceeded 2¾ degrees. Rate of penetration averaged 7.32 feet per hour (a record for this field) and only 9 bits were used to drill 595 feet.* This contractor saved 330¼ hours drilling time, the cost of four rock bits, and four round trips. Excerpts from the bit records, shown in the tables above, give the story in detail.

This is an outstanding example of the benefits that result from running **REED** Twin-Blast Rock Bits and following the suggestions of your **REED** representative as to drilling weight, pump volume and rotary speed.

REED ROLLER BIT COMPANY
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CANADA

Four Discoveries Indicated In Three Western Provinces

Four wildcats in western Canada this week gave up encouraging oil showings during drill-stem tests, with indication that commercial oil production may be possible after further testing operations, and one Alberta exploration venture discovered natural gas.

Two of the wildcats that yielded oil showings are in Alberta, while one is in Manitoba and the other is in Saskatchewan. One of the Alberta ventures is in the Hespero area of central Alberta, about 22 miles west of Red Deer. This well flowed D3 Devonian oil to the surface during a D3 drill-stem test after encountering a sizable gas zone above. That drill-stem test, down to 8,923 ft., also gave up formation water and crew has now set string of production casing.

This well, Hudson's Bay-Amurex-Richfield 16-32 Medin, LSD 16, 32-28-3w5, ¾ mile from the team's first well that discovered Mississippian and D2 Devonian oil. Previously this 16-32 Medin well had found oil in both the Mississippian and the D2 horizons.

In the Hamilton Lake area, about 65 miles northeast of Drumheller and 3½ miles west of Hamilton Lake area Viking oil wells, the team of Calvan Consolidated Oil & Gas Co., Ltd., Charter Oil Co., Ltd., and Ryerson Mining, Ltd., indicated Viking oil discovery, at a venture on farmout from Sun Oil Co.

This test well, Calvan-Charter 9-30 Sun, LSD 9, 30-35-10w4, was drill-stem tested from 2,954-77 ft., and pipe recovery was 195 ft. of oil and 120 ft. of heavily oil-cut mud. Hole was taken down to 3,007 ft. and string of production casing was set for further testing.

Manitoba . . . The Manitoba oil showing was made at the joint Sapphire Petroleums, Ltd., Henderson Oil Holdings, Ltd., Select Oils, Ltd,. and West Canadian Petroleums, Ltd., wildcat in the West Willen area. This southwest Manitoba encouragement came at the Sapphire 1 West Willen well, which is 5 miles east of the Saskatchewan border and about 25 miles north-northwest of Daly Mississippian oil field. It is located on LSD 9, 11-14-29w1.

Saskatchewan . . . The Saskatchewan oil encouragement was also found in the Bakken silt, at a Socony-Vacuum Oil Co. of Canada, Ltd., wildcat in the Harptree area, 75 miles south of Moose Jaw and 10 miles southwest of the Socony-Sohio 11-10 abandonment.

This venture, Socony-Sohio 21-4 Harptree, LSD 4, 21-4-26w2, entered the Bakken silt at 6,235 ft. or 3,807 ft. subsea and drill-stem tested from 6,250 to 6,301 ft. for 1½ hours. Pipe recovery consisted of 280 ft. of water cushion that was cut with free oil, 1,120 ft. of highly gassified watery mud and oil emulsion, and 180 ft. of sulfurous water. Crew was running logs prior to setting production casing at latest report.

The natural gas strike this week was made in the first Bow Island sand at the Canadian Export Gas, Ltd. wildcat in the Gem area of southern Alberta, 70 miles east of Calgary.

The venture, Canadian Export Gas-Ohio-Midcon 6-7 Gem, LSD 6, 7-23-17w4, is 10½ miles west-northwest of the nearest previous driller, and abandonment, and a few miles north of Bassano town.

First Bow Island drill-stem test from 3,266 ft. for 1 hour, flowed gas at maximum rate of 1,000,000 cu. ft. daily, with no evidence of formation water. Crew has penetrated 8 ft. of gas sand at that depth, and a later drill-stem test indicated that the gas zone had

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2. Because of this and other Higgins construction, we have jigs built and ready for tugs of all types. So Higgins can give you *faster delivery.*
3. By doing the job faster, labor and construction costs are cut to the bone. So Higgins can *save you money.*

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been penetrated 8 ft. at that depth, and a later drill-stem test indicated that the gas zone has been fully penetrated as only a small gas blow was obtained. The well is deepening.

Wayne area . . . An initial potential of 262 bbl. of 29°-gravity A.P.I. clean oil per day was established at the Wayne area basal Cretaceous oil discovery well that was drilled by Great Plains and Triad.

This venture discovered its basal Cretaceous oil during drill-stem test during the later part of August. The well, Great Plains-Triad-Socony 6-22 Wayne, LSD 6, 22-27-20w4, is 9½ miles south of Drumheller and 58 miles east-northeast of Calgary. It is about 2 miles northwest of the group's Viking gas well in the area and 2¼ miles west-northwest of the team's capped detrital "wet" gas strike.

The 24-hour production test that yielded 262 bbl. of oil was run through a ¼-in. choke. Gas-oil ratio was 537 cu. ft. per bbl. Production testing is continuing and it is expected that the team will select site for another driller in the area shortly.

TEXAS

WEST TEXAS

Ralph Lowe Completes Third Ellenburger Well

The third Ellenburger well in the new Deep Rock-Ellenburger pool of central Andrews County has been finished as a flush producer.

Ralph Lowe 1 Humble-King, SE SE 11-A46-PSL, a northwest offset to 1 Southland Royalty Co., flowed 594 bbl. of oil in 6 hours and was given a daily potential of 2,376 bbl. Choke size was 1-in. and pay section was open hole at 12,147-12,235 ft., total depth.

No. 1 Humble-King entered the Ellenburger at 12,142 ft., minus 8,966 ft., which is structurally high to the field's two other producers. The well was originally drilled dry to 5,828 ft.

Midland County . . . Forest and Cities Service 1-B Dora Roberts, prospective discovery or connecting well between Ellenburger production in Headlee field on the north and Virey to the south, prepared to drill ahead. The well made a heavy flow of oil on drill-stem test at 12,890-12,958 ft. No. 1-B Roberts topped the Ellenburger at 12,890 ft., minus 10,039 ft., which was 108 ft. high to the nearest Ellenburger well in Headlee field.

Forest and Cities Service have staked four offset locations to the 1-B Roberts, to be drilled one at a time. All locations are in Section 42.

Terry County prospect . . . Midwest Oil Corp. 1 Guetersloh, 10 miles south of Brownfield, reported a flow of oil while drill-stem testing in Pennsylvanian reef.

The reef was entered at 8,844 ft., by samples, on estimated elevation of 3,242 ft. On the test, at 8,846-64 ft., gas surfaced in 5 minutes and oil in 90 minutes, which flowed at the rate of 25 bbl. hourly. Flowing pressure ranged from 425-1,925 psi. Operators prepared to test again to 8,894 ft., total depth.

Reeves County . . . Gulf Oil Corp. 1 Northrup, Texas' depth record well, unloaded mud and water blanket on drill-stem test at 18,544-18,609 ft., with no shows of oil reported. The testing tool was open 7 minutes. Water blanket started unloading after one joint of pipe had been pulled.

Gulf's 1 Toyah Unit has made several gas flow tests in the Devonian. Dry gas was coming from 12,570-12,610 and 12,690-12,975 ft. On ¼-in. choke the well flowed at the rate of 20,000 M.f.g. per day, and at the rate of 6,090 M.f.g. daily when changed to ⅛-in. choke.

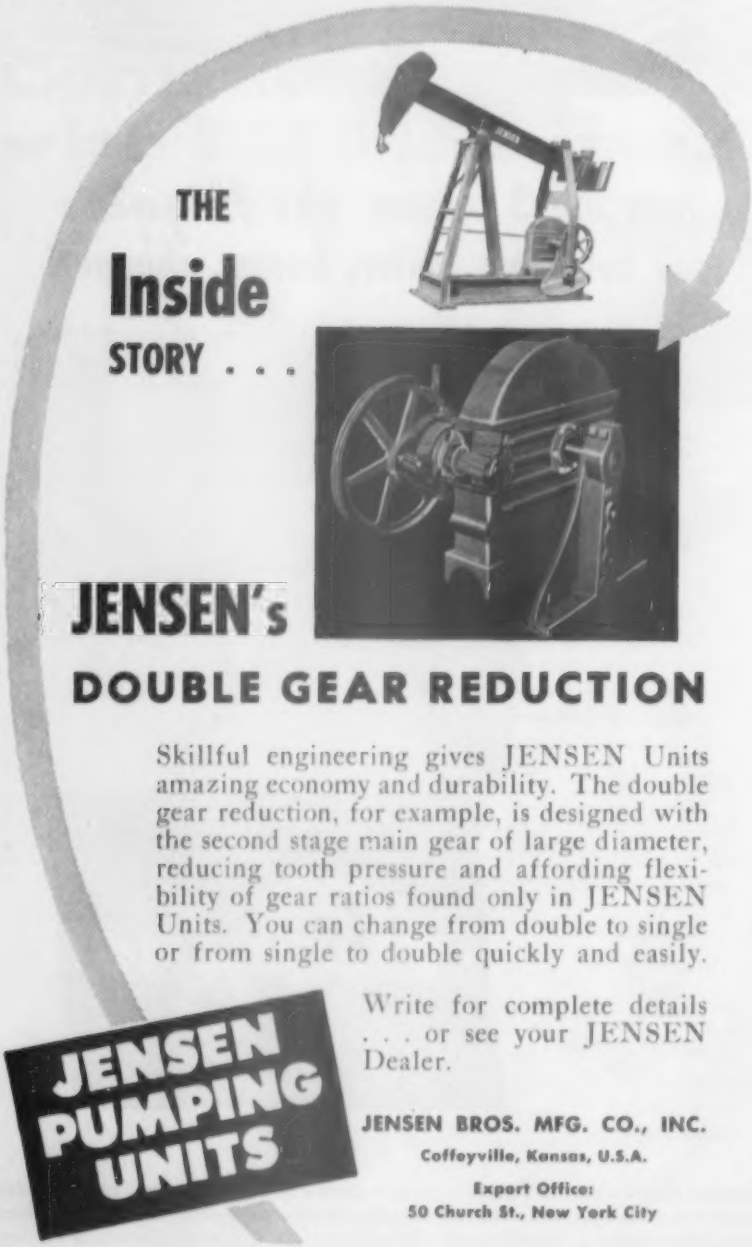
Ward County . . . British-American Oil Producing Co. 1 Tubb, Ellenburger wildcat 3 miles north of Clear Fork and Glorieta production in West Sand Hills field, made a good flow of oil on drill-stem test in the Glorieta from 3,979-4,080 ft., then flowed gas and distillate from the Silurian.

Top of the Devonian, by samples, was 6,228 ft. That formation was relatively thin and top of the Silurian was found at 6,236 ft. On drill-stem test at 6,295-6,330 ft., open 2 hours, gas showed in 3 minutes and recovery was a small amount of distillate. Gas flow through ⅜-in. choke was at the rate of 2,200 M.f.g. per day. Another gas flow was made at 6,330-78 ft.

EAST TEXAS

Bacon Limestone Discovery Completed in Henderson

Westbrook Oil Corp. 1 Allen heirs and W. R. Kinabrew has been finished as a good flowing discovery from the Bacon limestone at 7,604-12 ft. Location is 3 miles south of Malakoff and 1½ miles northeast of similar production in South Malakoff field. Completion gage was 323 bbl. of 46° oil through ⅞-in. choke. Flowing pressure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was 1,150 psi. on tubing and gas-oil ratio was 1,079 cu .ft.

Marion County . . . F. R. Jackson 1 Jim Colley, approximately 5 miles southeast of Lodi, in the William Edmondson Survey, A-122, completed as a Mitchell sand discovery. The wildcat flowed 123.75 bbl. of 41° oil a day through ¼-in. choke, from perforations at 5,986-98 ft.

The same operator's 1 Fant, located 1 mile northeast of production in Rodessa field, and 3 miles to the west of 1 Colley, has been completed as a small extension well. Pumping potential was 29.6 bbl. of 42° oil a day from perforations at 6,147-59 ft.

NORTH TEXAS

Confirmation Well Is Also New Pay Discovery

L. O. McMillan 1 Harry Reast, second well in the new Pennsylvanian pool 5½ miles north of Whitesboro in Grayson County, has added Oil Creek pay to the area and has been completed as a dual producer.

Top of the Oil Creek sand was picked at 7,380 ft. and operators logged 10 ft. of sand pay in drilling to 7,392 ft. Elevation is 771 ft. Completion potential from the lower zone was 144 bbl. of 30° oil a day through 14/64-in. choke. Tubing pressure was 200 psi. and gas-oil ratio 494 cu. ft.

Completion in the Strawn section was from 6,390-6,412 ft. Flowing potential through 10/64-in. choke was 330 bbl. of 32° oil, with casing pressure of 810 psi. and gas-oil ratio of 466 cu. ft.

McMillan's 1 Foster was Strawn discovery well for the field, which had Strawn pay at 6,406-6,412 ft. and flowed 244 bbl. of oil a day on 12/64-in. choke.

New wildcat location for north Grayson County is Howell, Holloway and Howell 1 Texas Nurseries, which will be drilled to 5,500 ft. Location is in the Joseph Strickland Survey, A-1068, 4½ miles northwest of Pottsboro and about 6 miles northwest of nearest production in Big Mineral Creek area.

Montague County . . . Star Oil Co. 1 McCall, Caddo conglomerate discovery 4½ miles southwest of Nocona, has been completed on the pump for 120 bbl. of 40° oil a day. Pay section was perforated from 6,250-58 ft.

Final gage has been turned in for Arnold H. Bruner 1 McCall-Fooshee, conglomerate discovery or long extension north of Minor field, 3½ miles northwest of Montague. Potential was 263 bbl. of 40° oil a day through 28/64-in. choke, from perforations at 6,284-90 ft. Tubing pressure was 275 psi. and gas-oil ratio was 675 psi.

Fisher County . . . Humble Oil & Refining Co. 1 Touchstone-Maberry, Pennsylvanian reef discovery 6 miles northeast of Trent, has been completed for 333 bbl. of 42° oil a day. Flow was through ¼-in. choke, from perforations at 4,797-4,817 ft. Top of pay was 4,797 ft. on ground elevation of 1,830 ft. Humble's second test for the area will be a west offset, as the 2 Touchstone-Maberry.

TEXAS GULF COAST

Liberty Frio Pay Spreads

Frio production on the north side of South Liberty field is being extended farther to the north by Claud B. Hamill at his 2 Gulf, being completed as an oil producer in sand interval at 3,526-40 ft. Total depth is 3,851 ft.

Testing through ¼-in. choke, the well flowed at the rate of 125 bbl. of oil per day under pressure of 135 psi.

New Stratton Ridge Well Extends "Het" Production

E. Cockrell, Jr., has completed another Heterostegina-lime producer in the South Stratton Ridge area, Brazoria County. The new well, 4 Bowers, confirms the new-pay discovery made by this operator last June at his 6-A Brock, 1½ miles to the southwest.

The new well, producing from open hole at 5,343-48 ft., flowed at the rate of 103.20 bbl. of 22.8°-gravity oil per day through choke under pressure of 550 psi.

Location is about 600 ft. northeast of the operator's 3 Bowers, producing from Robulus sand at 5,377-5,412 ft. The area is about 6 miles east of Clute.

Magnet-Withers Extension Starts New Drilling Play

New drilling activity is getting under way on the south flank of Magnet-Withers field, in Wharton County, following the recent extension by Smith & Smith, of Miocene gas production more than ½-mile to the south.

The initial extension well, 1 Harriet Thompson, was completed the middle of September. Since then, the same operators have brought in another gas well, 1 Stovall, 1,500 ft. farther to the southwest.

Three additional wells are being started, including 1-B Harriet Thompson, 2,500 ft. west of the new Stovall gasser; 1 Hugh Thompson, 3,500 ft. to the northwest of the former; and 1-B Blue Creek, 2,860 ft. to the southwest.

Also on the south side of Magnet-Withers field, but several miles to the east, Harrell Oil Co. is starting a 7,000-ft. test at 1 Sweet-

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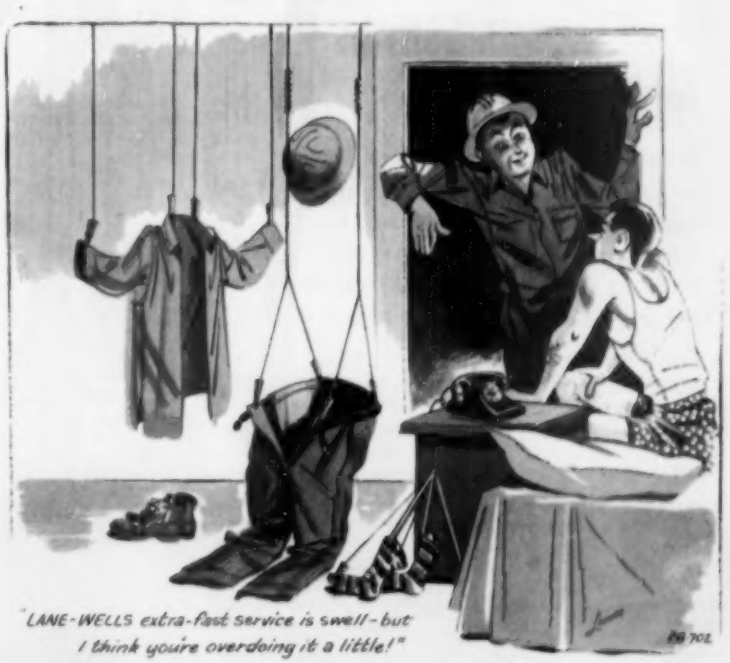

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Franz Unit. Location is in the Smith & McKenzie Survey.

Smith & Smith's new Miocene gassers produce from a 4,200-ft. zone, the interval in the initial well being at 4,235-45 ft., and in the newer well at 4,275-80 ft. Potential gages were 20,500,000 cu. ft. of gas daily in the first, and 14,200,000 cu. ft. of gas daily in the second. The gas is dry.

SOUTHWEST TEXAS

New Producer Extends San Salvador Gas Area

Gas production in the San Salvador area, Hidalgo County, is being extended approximately 5,500 ft. to the southeast by a new outpost completion by Western Natural Gas Co.

The extension well, 2 Santa Cruz Farms Unit, in San Salvador del Tule Grant, flowed an unreported volume of gas with tubing pressure of 1,125 psi. through 3/8-in. choke. Pressure with well shut in is 2,725 psi.

Flow was from a perforated sand interval at 7,638-76 ft.

Western Natural Gas Co. reports completion of two additional gas wells at San Salvador. They are its 1-B Cavazos and 2 Juan de la Vina, both producing from a 6,500-ft. sand.

Deep Bruni Test Makes New-Pay Oil Discovery

Potential flow at Hill, Dugger & Kuenstler's new-pay discovery well in Bruni field, Webb County, was at the rate of 140.51 bbl. of 36.7°-gravity net oil per day. Gage was through a P-37 choke. Pressure was 580 psi. and gas-oil ratio 719 cu. ft. per barrel. Water yield was at the rate of 18 per cent of the total fluid produced. New pay is perforated at 5,639-44 ft. and is designated as Zone "B." Location of the well, in Block 7, J. R. Foltz Subdivision, Mariano Grant, is 2 miles east of the Bruni townsite.

Frio Wildcat Produces

Theljohn Oil Co. is opening a new producing area 4 miles northeast of Big Foot, in Frio County, where its 1 Carl Davidson, in the Samuel Brown Survey, flowed at the rate of 10 to 12 bbl. of oil per hour after pay zone at 2,420-23 ft. was fractured.

HUGOTON EMBAYMENT

Southwest Camp Creek Has New Pay Zone Assured

A new pay zone is assured Beaver County, Oklahoma Panhandle's Southwest Camp Creek field.

American Gas Producing Co. 1 Shadden, SE SE 26-3n-24eCM, flowed gas at 1,800 M.c.f. per day after fracturing from perforations at 5,476-94 ft. The field produces from only one well in the Morrow sand.

Greenough field . . . This Beaver County producing area has a successful gas-distillate well assured at J. M. Huber Corp. 1 Davis, 30-6n-22eCM. The well flowed 11,295 M.c.f. of gas per day and 35 bbl. of distillate on 6-hour test through a 1-in. choke. Production is from perforations at 6,117-29 ft. in the Morrow. The well also flowed gas from Mississippian pay.

OKLAHOMA

New Hughes Producing Area Has Two New Wells

Hughes County's new Gilcrease sand producing area in 9n-10e, 1 mile west of abandoned East Wetumka district production, got two new gas wells.

Powel Briscoe 1 Gafford, SW SW NE 15-9n-10e, flowed 8,000 M.c.f. of gas per day plus 12 bbl. of oil per hour on 12/64-in. choke from perforations at 2,698-2,704, 2,764-68, 2,792-96, and 2,820-24 ft. in the Gilcrease sand.

Briscoe's 2 Gafford, NW SW NE 15-9n-10e, flowed 10,100 M.c.f. of gas per day.

David W. Taylor and Leslie Walker opened the new area at 1 Doyle, NW NW SE 15. The discovery well flowed 120 bbl. of oil in 12 hours on ⅛-in. choke from Gilcrease perforations at 2,830-39 ft.

Logan County Report

A good flowing oil well is reported at D&L Oil Co. 1 Freudenberger, SE SE 9-17n-1w, West Langston pool, Logan County.

The well flowed 23 bbl. of oil during the first hour from Skinner sand after recovering fracturing load. The well flowed 14 bbl. of oil during the second hour on ½-in. choke. On ¼-in. it flowed 86½ bbl. in 11 hours.

Completion of E. R. Bahan et al 1 Hill, NW NE SW 5-18n-4w, Logan County, promises to fill in the link between North Lovell and Northwest Lovell pools. The Layton sand gas well flowed an estimated 10,000 M.c.f. of gas per day. Recovery on a test at 4,786-4,850 ft. was 1,710 ft. of oil and 180 ft. of oil-cut mud.

MICHIGAN

A third Traverse oil pay was encountered, while deepening operations were in progress with the Dundee objective as the next intended pay horizon, at the Miami Operating Co., Inc. 4 Hope, NW NW NE 12-20n-6w, Winterfield Township, Clare County, a well which was originally completed in the top Traverse pay at 3,256 ft., total depth in Cranberry Lake field.

New total depth was at 3,311 ft. where flowing pay was encountered. Well flowed as much as 20 bbl. of oil an hour on test, was estimated good for 500 bbl. of oil a day natural, but production was being restricted to 150 bbl. daily through a 15/64-in. choke. There was no water showing. Top of Traverse lime was logged at 3,184 ft. and production was rated good for 60 bbl. of oil daily after a 250-gal. acidization. Most of the oil producers in Cranberry Lake are in the Richfield pay zone, with a few spotty Traverse and Dundee producers.

This is the first well definitely known to be producing from this so-called third Traverse pay. Actually, it may be the second well in the pool being produced from this horizon. Sun Oil Co. 1 Randall, completed much earlier, may be in this horizon, but it is unknown for sure exactly which zone the Sun 1 Randall is being produced from. It is not expected that new drilling will be stimulated by this very good completion, but considerable rework at previously drilled oil wells may follow.

Edward Torosian 2 Nerreter, NE SE NE 2-1s-7e, Washtenaw County, on the west side of Northville Trenton oil pool, may be the next (and second) top, or upper Trenton oil

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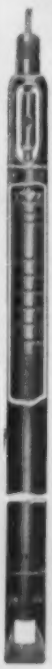

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producer in the pool capable of producing field allowable production of 200 bbl. daily. Although information from the well was being held semiconfidential, cores from the Trenton, plus loss of circulation while coring was in progress indicated exceptional porosity. Top of Trenton was logged at 4,220-23 ft. and hole was bottomed out at the "thief zone," 4,460 ft. A complete pit of drilling mud was lost while coring was in progress, but most of this was regained in "nothing flat" on a drill-stem test. Vugs from 2 to 3-in. in diameter were found in the last core. Well was cased with 5-in., will be cleaned out, tested and completed with cable tools.

APPALACHIAN AREA

WEST VIRGINIA

Otter district, Braxton County, West Virginia, Otter Gas Co. 1 Hugh Beckett, rank deep wildcat was dry, elevation 923 ft., Onondaga 6,500-6,650 ft., Oriskany sand 6,674 ft., show of gas, TD 6,725 ft.

Dry Fork district, Randolph County, Columbian Carbon Co. 1-1202 United States of America, elevation 3,036 ft., recorded the Onondaga at 4,648 ft., the chert at 4,703 ft., and shut down at 4,707 ft., to cement. In Roaring Creek district, Randolph Gas Co. 2 King & Avington, elevation 2,512 ft. gaged 493,000 cu. ft. gas, Fifth sand 2,090-2,156 ft., gas 2,120 ft. TD 2,156 ft.

PENNSYLVANIA

Cherry Hill Township, Indiana County, Southwest Pennsylvania, Chestnut Ridge Oil & Gas Co. reached the bottom of the Oriskany sand at 7,944 ft., and shut down at 8,005 ft., and may sandfrac. In Grant Township, Fairman Drilling Co. 1 Herb Gernandt, is drilling at 6,950 ft. Monroe Township, Bedford County, John Galey 1 Donald H. Miller, shut down at 5,300 ft., for Sandfrac.

OHIO

The Oriskany gas pool in the south part of Royalton Township, Cuyahoga County, was enlarged by H. A. Dempsey 2, R. C. Gordon, Section 14. Sand at 1,790-1,823 ft. gaged and was tubed at 900,000 cu. ft. natural.

Clinton wells are now being drilled with success in the old Berea sand pool in southeast Fallsbury Township, Licking County. Ulmer and Sons 18 D. Moran, Section 22, with sand at 2,962-3,014 ft. made 90 bbl. in a 24-hour test after fracturing.

Along the southeast side of Mount Zion pool, National Gas 2 Fred Ashcraft, Section 23, Jackson Township, Knox County, found three good showings in the Clinton from 3,033-3,069 ft., and produced 200 bbl. in 24 hours after fracturing.

ARKANSAS

Scott County Prospect Reports Gas Showing

A rank wildcat in Scott County, northwest of Waldron in west-central Arkansas, has reported a dry gas show. It is Critchell Parsons and John C. Robbins 1 Wilson heirs, C SW NE 19-3n-29w. Top of the gas sand was found at 2,440 ft. The sand is in what is believed to be the Atoka series. Operator is drilling ahead.

LOUISIANA

SOUTH LOUISIANA

New Production Opened By Gueydan Relief Well

Pure Oil Co. is opening a new gas-condensate producing area 2 miles southeast of Gueydan and about 3 miles south of Gueydan field, in Vermilion Parish.

Discovery well is the company's 2 Vermilion Parish School Board, 2,000 ft. south of the company's initial test (1 Vermilion), which has been standing since a blowout and fire early this year.

It flowed gas and condensate with pressure, through 20/64-in. choke, of 3,800 psi. when starting tests of Miocene sand interval at 10,498-516 ft. No gage of volume was reported.

The first well blew out while coring below 11,441 ft. The new well, started as a relief well, was drilled to 11,586 ft., the blowout well, in the meantime, having killed itself. Casing was run to 11,420 ft.

Second Horizon Opened In Deep Lake Extension Area

Multiple-pay production of the widespread Deep Lake gas-condensate field, in Cameron Parish, has been established in the new extension area 2 miles southwest of the original field.

Union Producing Co.'s second well, 2 State Lease 2340-Rockefeller, in the new area has been completed in a sand more than 1,200

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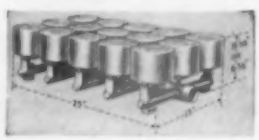

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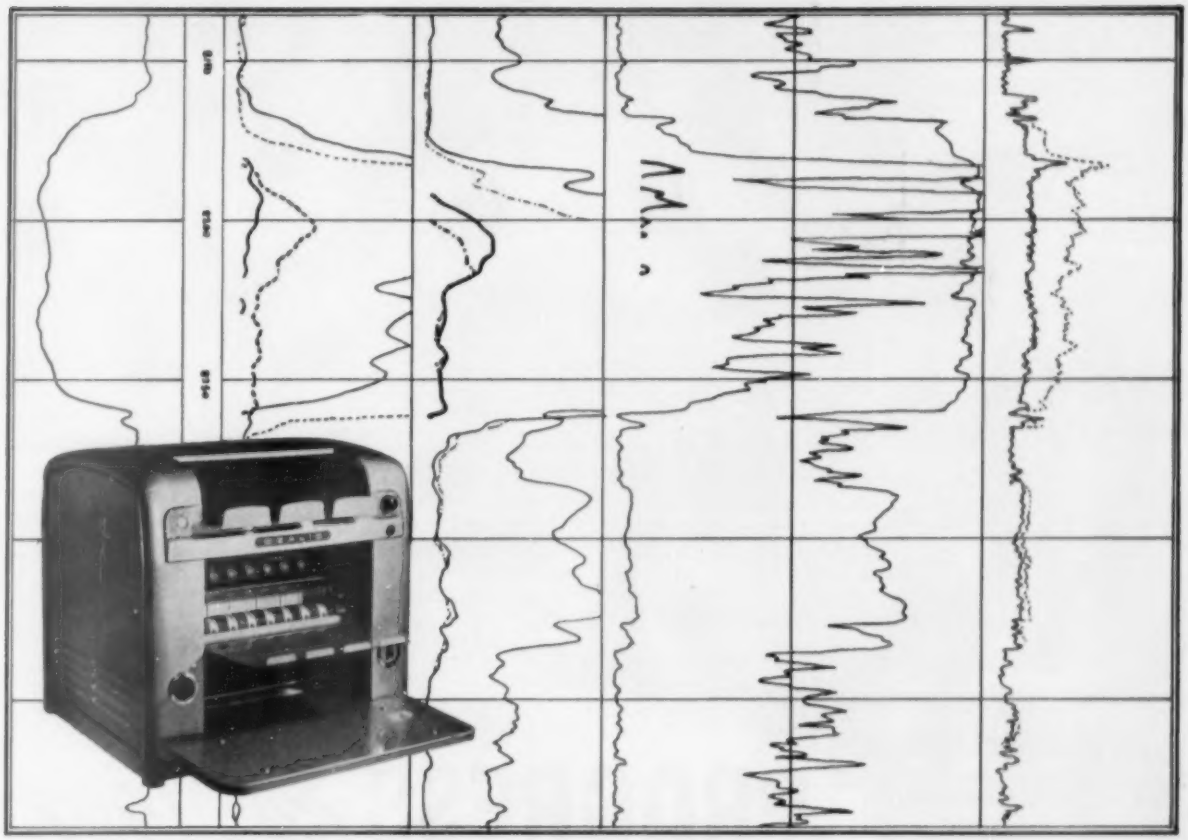

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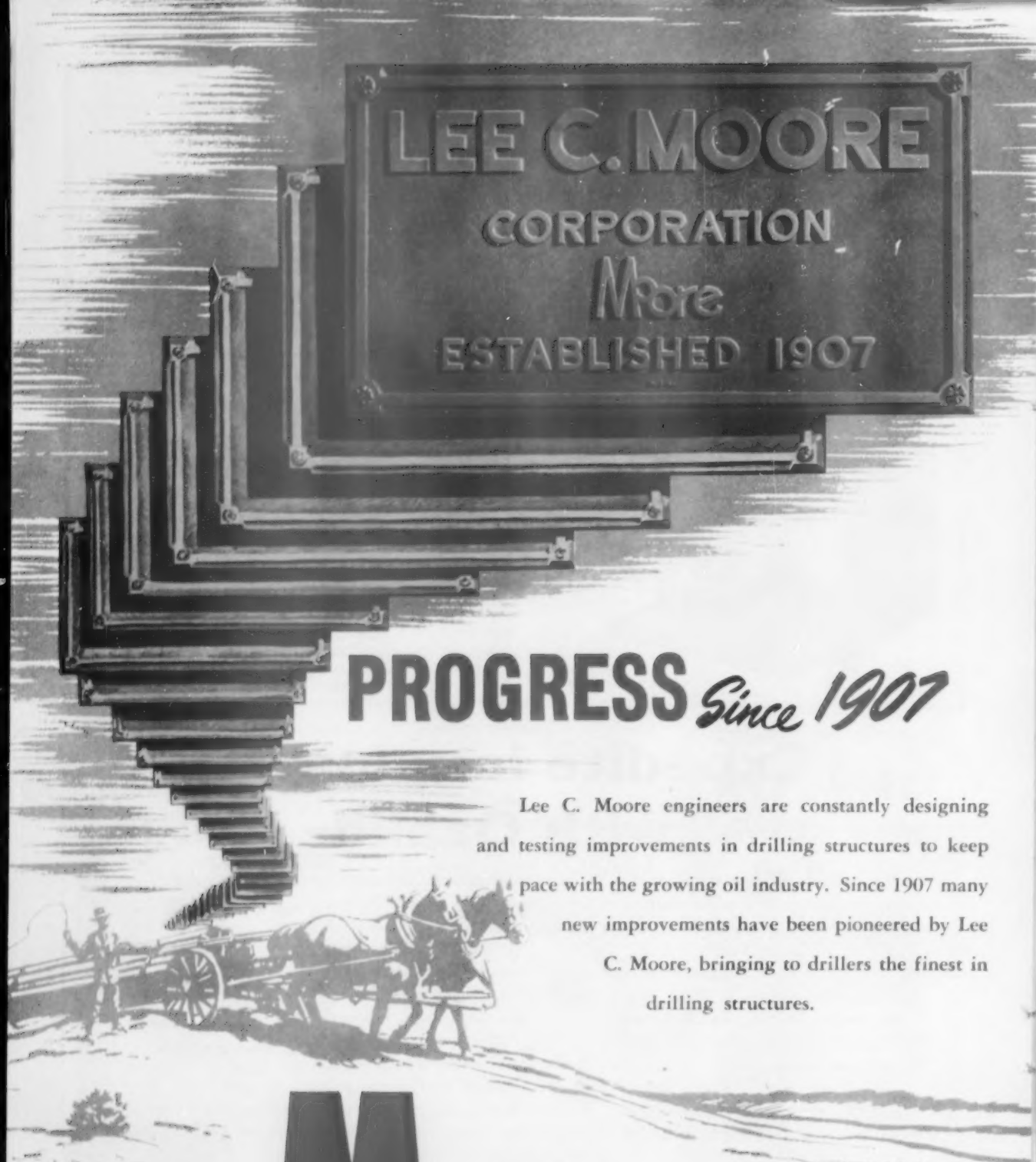

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ft. below the pay zone in the initial well. It produced at the rate of 8,020,000 cu. ft. of gas per day through 20/64-in. choke from a sand interval at 14,380-84 ft. Pay interval of its initial extension well, completed last March, is 13,140-42 ft.

Rig on the second well is being moved to a location southwest of the first well for the company's third test on the same lease.

NEW MEXICO

SOUTHEAST NEW MEXICO

More Devonian Gas Found in Shallow Field

Anderson-Prichard Oil Corp. 1 American Republics Corp., 28-25s-37e, located in the southern tip of Langlie-Mattix field, Lea County, has reported a second flow of gas.

Operators drilled into the Devonian at 8,275 ft., minus 5,252 ft. The well blew out while at total depth 8,350 ft., making an estimated 50,000 M.f.g. per day. Tools were lost in the hole and a whipstock set at 6,320 ft.

A drill-stem test was made in sidetracked hole at 8,276-8,320 ft. Gas surfaced in 5 minutes, making an estimated 16,000 M.f.g. per day, plus some distillate, drilling water and mud. Operators were to drill another 50 ft. and retest.

Second drill-stem test was run at 8,371-8,461 ft. Gas showed in 2 minutes and volume was gaged at 4,500 M.f.g. Flowing pressure was 160 psi.

Continental Oil Co. 2 Bell Lake Unit, 30-23s-34e, reported soft drilling and a gas kick at 12,906 ft. Drilling continued below 12,927 ft.

ILLINOIS

Excellent oil saturation is being pump-tested in White County at Eastern Petroleum Co. 1 Rice, SE NW SW 22-5s-10e, 2 miles northeast of Maunie. The tests are being made at 2,085-2,105 ft. in the Clore sand. The Palestine sand at 2,233-41 ft. gave up 2 bbl. of oil per hour natural on swab test.

N. V. Duncan Estate 1 School Trustees, NE NE SW 16-9s-9e, 3½ miles southeast of Ridgway in Gallatin County is swabbing at the rate of 168 bbl. of oil per day after fracturing from the Cypress sand at 2,276-82 ft.

MISSISSIPPI

Black Warrior Basin Gets First Discovery This Year

W. C. Feazel and associates have succeeded in completing a small gas well in their 1 Rea, a previously abandoned wildcat test, 10 miles southeast of Aberdeen, in southeastern Monroe County.

The new field opened by the well is the only discovery so far this year in northeastern Mississippi's portion of the Black Warrior basin, which has been relatively inactive for several months.

The hole, drilled to 4,395 ft. in Devonian before it was abandoned in July 1952, was reentered early in September, this year. After drill-stem tests had indicated possible gas production in the Chester-Carter sand, casing

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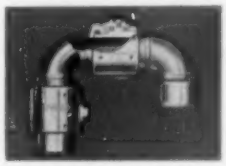

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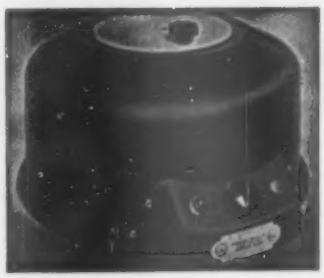

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was run 3,684 ft., through not only the Carter zone but also the deeper Sanders sand.

The latter sand was tested first with casing-perforations at 3,509-27 ft. and 3,553-63 ft. and the interval fractured. Tests yielded salt water with only a trace of gas.

The Carter sand then was opened with perforations at 3,360-69 ft. Pay was fractured, and on potential tests, the well, flowing through ⅛-in. choke, produced at the rate of 2,150,000 cu. ft. of gas and 56 bbl. of water per day.

The discovery is 4 miles northeast of the town of Hamilton, for which it has been named. It is 15 miles east of Muldon field, nearest production.

CALIFORNIA

Discoveries Increase Huntington Beach Activity

Recent successes in the vicinity of Huntington Beach, Orange County, caused two new wildcats to be scheduled. Atlantic Oil Co. 1 Ramser will be drilled in 29-5s-11w, and Hancock Oil Co. 1 Hancock-Alamitos was staked for 23-5s-12w.

The former is ¾-mile southeast of Burt Aston's recent field discovery at Sunset Beach and the latter is 1½ miles northwest of the discovery. A directional hole, 2 Lomita was drilled from a surface location in SE NE 19-5s-11w. It was completed in the interval 7,052-7,185 ft. for about 500 bbl. of 29°-gravity crude through a 24/64-in. choke.

South of Huntington Beach, Wilson Oil Co. and J. B. Crawford have completed five wells in Sections 11 and 14 of 6s-11w. Both operators had new wells under way.

Midway Discovery Offset

Standard Oil Co. of California was preparing to start 387 29-D as a northwest offset to Exeter Oil Co.'s. 5,300-ft. deeper pool discovery in the Midway-Sunset field, Kern County. Location of the new test is in SE SE 29-32s-24e. Completed for a daily rate of about 1,600 bbl., the discovery has been averaging about 1,000 bbl. daily through a restricted choke. Exeter's next test is expected to be a twin well to evaluate potential sands encountered at 4,450-4,650 ft.

Cymric Deep Test Started

Ohio Oil Co. was preparing to start a deep test on the eastern flank of Cymric field, 7 miles northwest of McKittrick in Kern County. The wildcat will be i San Francisco Bank et al in 23-29s-21e, about ¾-mile northwest of the 6,500-ft. Eocene discovery registered last year by Superior Oil Co. A depth of about 12,000 ft. is planned, using the big rig which established the world's depth record of 21,482 ft. in the Paloma field.

Airport Activity Increasing

A minor drilling flurry was shaping up in the vicinity of Long Beach Municipal Airport where The Texas Co. has recorded two discoveries on its 1,040-acre lease east of the old Signal Hill field. Most recent was its 2 Long Beach Airport, completed flowing 600 bbl. of 32°-gravity crude through a 17/64-in. choke and from an interval above 9,175 ft. Paulin Oil Co. 1 I.C.I., believed to be a western offset to the Texaco slant hole, was reported to have made a 300-bbl. producer at a depth of approximately 7,900 ft.

Two new operators are expected to enter the activity, which is centered around the western edge of the airport lease. Hancock Oil Co. holds an 80-acre tract, while the Termo Co. has smaller holdings.

KENTUCKY

EASTERN KENTUCKY

On Crooked Branch, Martin County, E. C. Ware has successfully completed 7 Amy Polley as a Devonian shale gas producer. On open flow, well gaged 280,000 cu. ft. of gas daily at a total depth of 2,940 ft.

On Levisa Fork and in the Floyd County sector of Big Sandy gas field Penn Fitzpatrick has completed 1 Cynthia Porter as a Big lime (Mississippian) gas well as same gaged 250,000 cu. ft. of gas daily from a total depth of 1,012 ft.

ROCKY MOUNTAIN

ARIZONA

Shell Running Casing at Boundary Butte Wildcat

Shell Oil Co. is running casing at 2 Boundary Butte Unit, C SE NW 3-41n-28e, Apache County. The operator recovered oil on drilling test at 4,750-4,950 ft., and will attempt completion as an oil well.

Tool was open in this interval for 2½ hours, and recovery was 540 ft. of very gassy oil with 420 ft. of black sulfur water.

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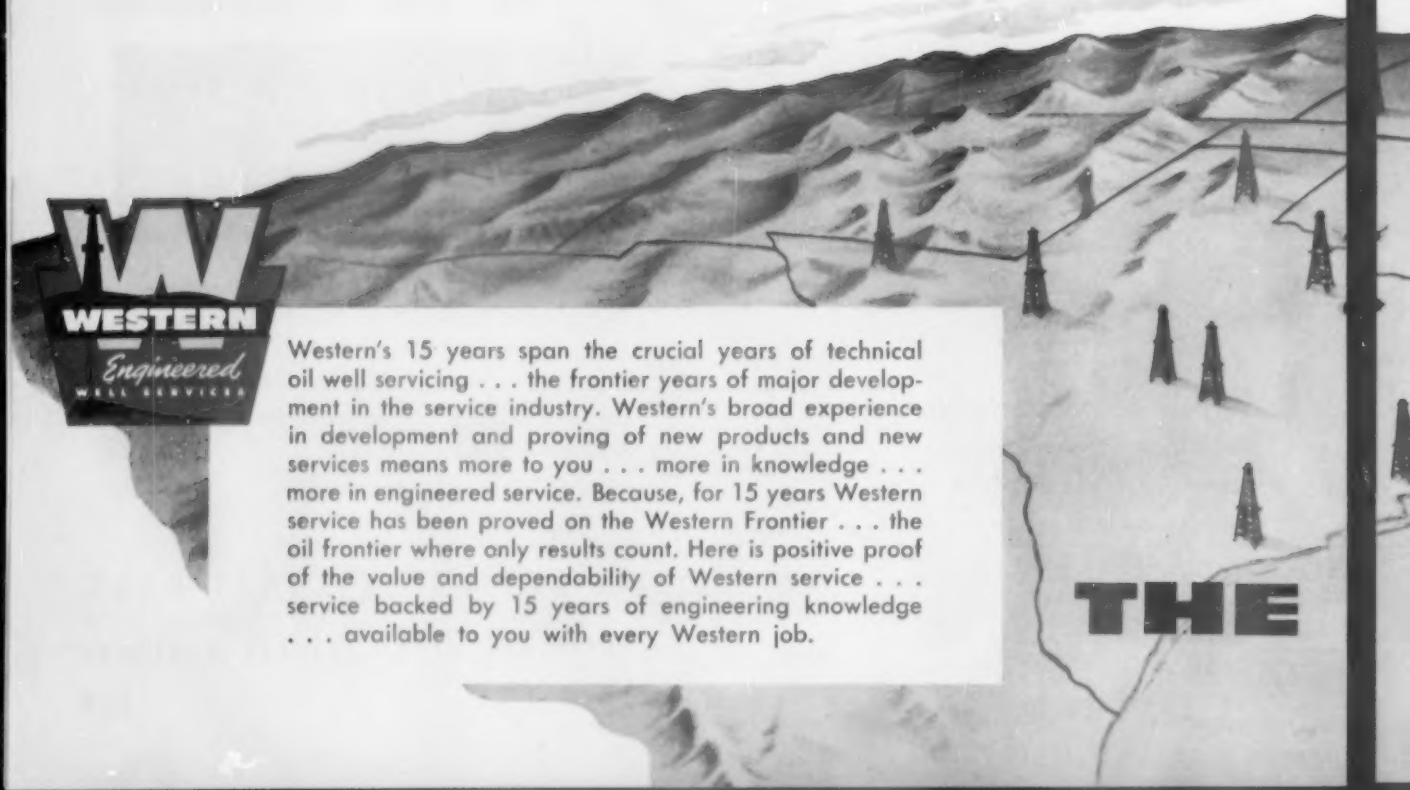

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Flowing pressure was 825-1,605 psi. Gas flowed after 18 minutes at the rate of 50,000 cu. ft. per day, with the flow dead after 85 minutes.

Shell drilled to a total depth of more than 6,300 ft. before plugging back to 4,950 ft. for completion. The well was previously reported a potential gas success after recovery of 3,450,000 cu. ft. of gas per day on test of upper Hermosa. Tops at the depth now being tested have not been reported by recovery is believed to be from Pennsylvanian formations.

The well is the second in this area for Shell in 1954. A previous test was temporarily abandoned after testing as much as a million cubic feet of gas per day, with only minor shows of oil. Gas volume declined substantially during testing of the first well.

MONTANA

West Poplar Wildcat is Apparent Success

Carter Oil Co. and Phillips Petroleum Co. are running casing at 1 Tribal, C SW SW 5-29n-50e, in the West Poplar unit, Roosevelt County. The well is an apparent discovery in the C zone of Madison, and is the fourth wildcat on this unit for the two operators. Earlier tests had no significant shows.

The current well made 724 ft. of clean oil, 207 ft. of oil-cut mud and 45 ft. of oil-cut salt water from the zone 6,446-61 ft. with tool open 4 hours. Carter and Phillips cored limestone with vertical fractures and shows of oil on fractures at the zone tested.

The well is the most northerly of the four tests drilled on the unit by Carter-Phillips, and is about 1¼ miles northwest of previous production in the area.

Immediately after the discovery of oil in the Montana portion of the Williston basin, Carter-Phillips deepened a 1950 failure on this unit with no success. Two later wildcats followed, also without success.

Pine Unit Production Extended Southward

Shell Oil Co. has tested two apparent producers in the Pine Unit, Wibaux County which will extend production in the field 1 mile to the south, giving a 6½ mile north-south extent to the producing area in the field. At 23-15-A Unit, C NE SW 15-11n-57e, Shell reported a flow of 635 bbl. of oil per day through ½-in. choke. Production is from Red River at 8,961-9,092 ft. Shell has perforated but has not yet tested zones in Silurian and in the Stoney Mountain.

Further south a drill-stem test of 21-22-A Unit, SE NE NW 22-11n-57e, flowed oil after 40 minutes, at the rate of 805 bbl. of fluid per day. Of this recovery 734 bbl. were oil. Tool was open for 2¾ hours and flowing pressure was 725-2,795 psi. Test was at 8,453-93 ft.

Shell now has 11 completed producers in the unit. Development has been conducted on a definition basis, with very little infield work done. One inside location is now drilling. The field is considered one important factor in construction of outlet for eastern Montana crude.

Clark's Fork Apparent Discovery Being Completed

J. Ray McDermott is running casing for completion of an apparent basal Frontier discovery in the Clark's Fork Unit, Carbon County. The well, 1 Unit, SE SW NW 27-9s-22e, tested 1,650 ft. of free oil at 6,715-57 ft. Total depth is on acreage farmed out to McDermott by British-American Oil Producing Co.

WESTERN NEBRASKA

Cheyenne County Discovery Completed

Gem Oil Co. has completed 1 Woten, NE NE NW 29-16n-52w, Cheyenne County, pumping 140 bbl. of oil per day. Production is from perforations in J sand at 5,444-57 ft. The well is 7 miles north of the town of Potter where there is no previous nearby production. A confirmation well has already been started.

UTAH

Blueball Wildcat Potential Discovery

Carter Oil Co. recovered gas with some oil on test of 2 Unit, C SW NW 3-1s-2w, in the Bluebell Unit, Duchesne County. Test was of the interval 7,875-7,915 ft. and with tool open 90 minutes gas flowed at the rate of 5 million cubic feet per day, estimated. Recovered in pipe was 147 ft. of oil and 147 ft. of gas-cut mud. Flowing pressure was 800-1,600 psi. Carter is reported drilling below 7,990 ft., with last top reported that of Green River at 7,055 ft.

COLORADO

Two Discoveries Gaged

Wytex Service Co. and Rex Monohan completed 1 Forbes, C SW SE 14-1n-54w, Washington County, for a pump gage of 155 bbl.

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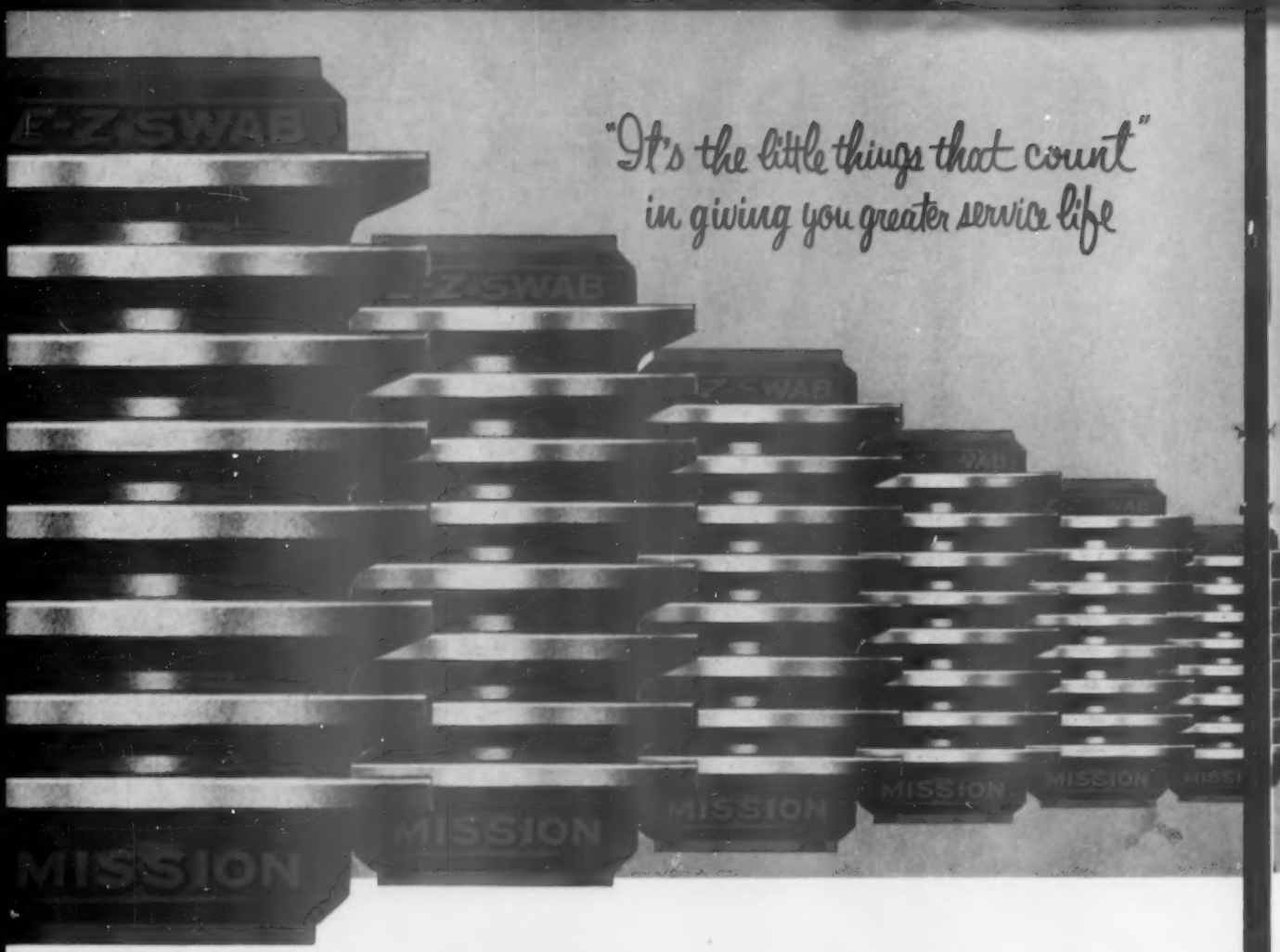

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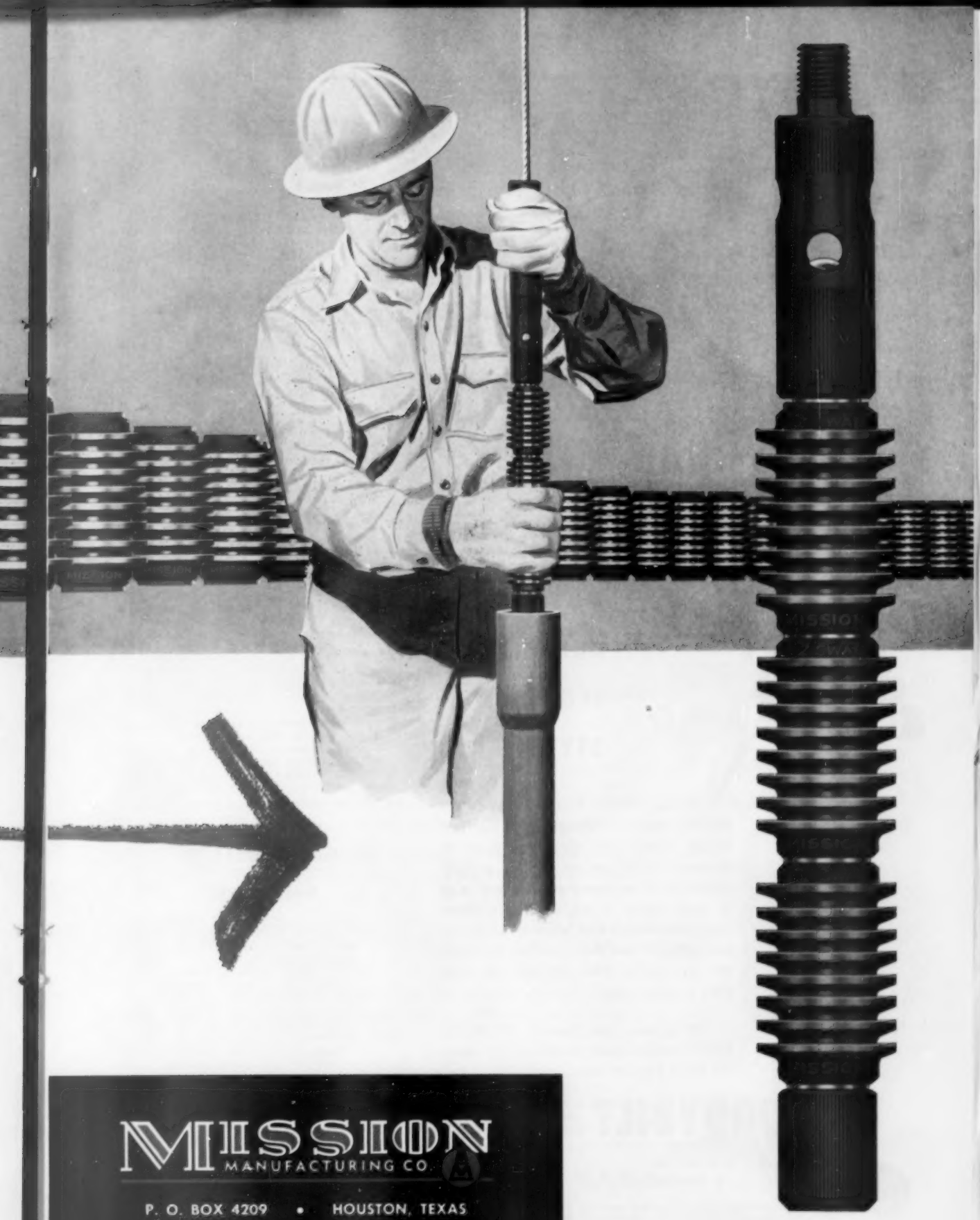

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of oil per day. The discovery produced from J sand at 4,993-95 ft. The new field has unofficially been named Rago, North.

In Morgan County, British-American Oil Producing Co. reported a flow gage of 235 bbl. of oil per day from 1 Hegarty, C NW SE 26-1n-59w, pool opener in Park field. The well produced from D sand, and is now shut in for storage.

WYOMING

Sheridan County Confirmation Well Successful

Shell Oil Co. recovered 2,752 ft. of oil on 45-minute drill-stem test of Ash Creek sand at 2 Hallworth, C SW NE 31-58n-83w confirmation to this operator's recent discovery in the Decker area, about 2½ miles south of production at Ash Creek field. Test was of the zone 4,732-90 ft. The well is southwest of the discovery, 1 Hallworth, SE NE NE 31-58n-84w, which was completed for 260 bbl. of oil per day.

Northern Big Horn Basin Wildcat Testing

Sun Oil Co. has begun swabbing from Phosphoria at 1 Ralston Unit, C NE NW tract 51-56n-101w, Park County. No results are available, with operator reported swabbing down preliminary to actual test. Sun recovered 800 ft. of free oil in 2 hours on drill-stem test of Phosphoria, topped at 12,660 ft. The formation was perforated at 12,640-12,680 ft.

The well is a deepening from former production in Frontier and was drilled to 13,299 ft. to test Madison.

Mule Creek Confirmation Attempt Fails

Mule Creek Oil Co. of Billings has abandoned a second well on the Big Polecat structure, Park County. The well failed to find production in Tensleep, and recovered only black sulfur water in tests of two intervals wthin that formation. The failure is 2 Unit, NE SW SW 22-57n-98w. It is southeast of a recent Tensleep discovery by this operator at 1 Unit, E½ SE SW 16-57n-98w, which was completed for 350 bbl. of oil per day, with more than 100 ft. of Tensleep pay reported.

Deep Powder River Basin Wildcat Finds Shows

Stanolind Oil & Gas Co. recovered 42 ft. of distillate with a small amount of gas on test of Lakota at 1 Sherwood Unit, C SE NW 3-40n-77w, Natrona County. Tool was open 1 hour in the interval 10,987-11,013 ft. Recovery also included 210 ft. of mud cut with distillate.

Previous test of Muddy sand in the wildcat recovered 135 ft. of oil and 720 ft. of heavily oil and gas-cut mud. The operator is reported coring below 11,015 ft. and will test to Tensleep.

NORTH DAKOTA

Deep Test Planned For Dunn County

Stanolind Oil & Gas Co. will be operator of a 13,500 ft. Winnipeg sand tentatively located in 11-146n-91w, Dunn County. The wildcat is to be a joint venture on a 640-acre block. Carter Oil Co., Cities Service Oil Co., Mobil Producing Co., and Sinclair Oil & Gas Co., are other interest holders.

Mobil Producing has recently abandoned a Dunn County test at F-32-24-P Kennedy, SW NE 24-149n-93w. Some oil was swabbed on test at 10,540-10,567 ft., but recovery was noncommercial on extended testing.

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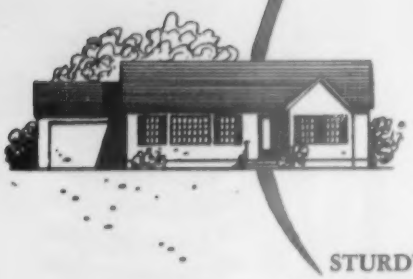

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Edwards County: American Republics Corp. 1 Holman et al, Sec. 51, Block A, C&M Sur., A-728. Dry. TD 1,529 ft.

Taylor Oil & Gas Co. 1 W. T. O. Holman estate, CCSD&RGNG Sur. 22. Dry. TD 9,518 ft.

Frio County: B. G. Byars and C. G. Dunwoody, Jr. 1-B Oppenheimer & Land, George Mangold Sur. 29, A-501. Dry. TD 5,109 ft.

Howeth & Mason and Holland Oil Co. 1 Lenoir, AB&M Sur. 5, A-29. Dry. TD 4,319 ft.

McCauley, Wood & McCauley 1 Harris, William Webber Sur. 106, A-668. Dry. TD 6,000 ft.

Guadalupe County: Stanolind Oil & Gas Co. 1 Schmidt, Gustavis Bunson Sur., A-72. Dry. TD 2,641 ft.

McMullen County: George H. Coates 1-C

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Chitwood & Sayre, Oklahoma

Douglas-Smith, Inc., Rig #1
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Louisiana Gulf Coast

Falcon Seaboard Drilling Co., Rig #S-3
4" MUDWONDER tested on standpipe
Church Point, Louisiana Gulf Coast

Schafer Drilling Co., Rig #U-15
2" MUDWONDER tested on jet line service
Beckham County, Oklahoma

Falcon Seaboard Drilling Co., Rig #18
2" MUDWONDER tested on jet line service
Purdy, Oklahoma

Parker Drilling Co., Rig #26
2" MUDWONDER tested on mud mixing line
Lindsay area, Oklahoma

Warren-Bradshaw Exploration Co., Rig #54
2" MUDWONDER tested on fill-up line
Purdy, Oklahoma

Gordon Drilling Co., Rig #3
4" MUDWONDER tested on standpipe
Church Point, La.

Gordon Drilling Co., Rig #3
2" MUDWONDER tested on fill-up line
Church Point, La.

H. Waggoner Drilling Co., Rig
2" MUDWONDER tested on jet line service
Blackwell, Oklahoma

Kidd Williams Drilling Corp., Rig #6
2" MUDWONDER tested on jet line service
Chitwood & Sayre, Oklahoma

Oil Production Maintenance, Inc., Rig #U-15
2" MUDWONDER tested on mixing pump discharge
Texas Gulf Coast Area

Schafer Drilling Co., Rig #5
4" MUDWONDER tested on mud pump discharge
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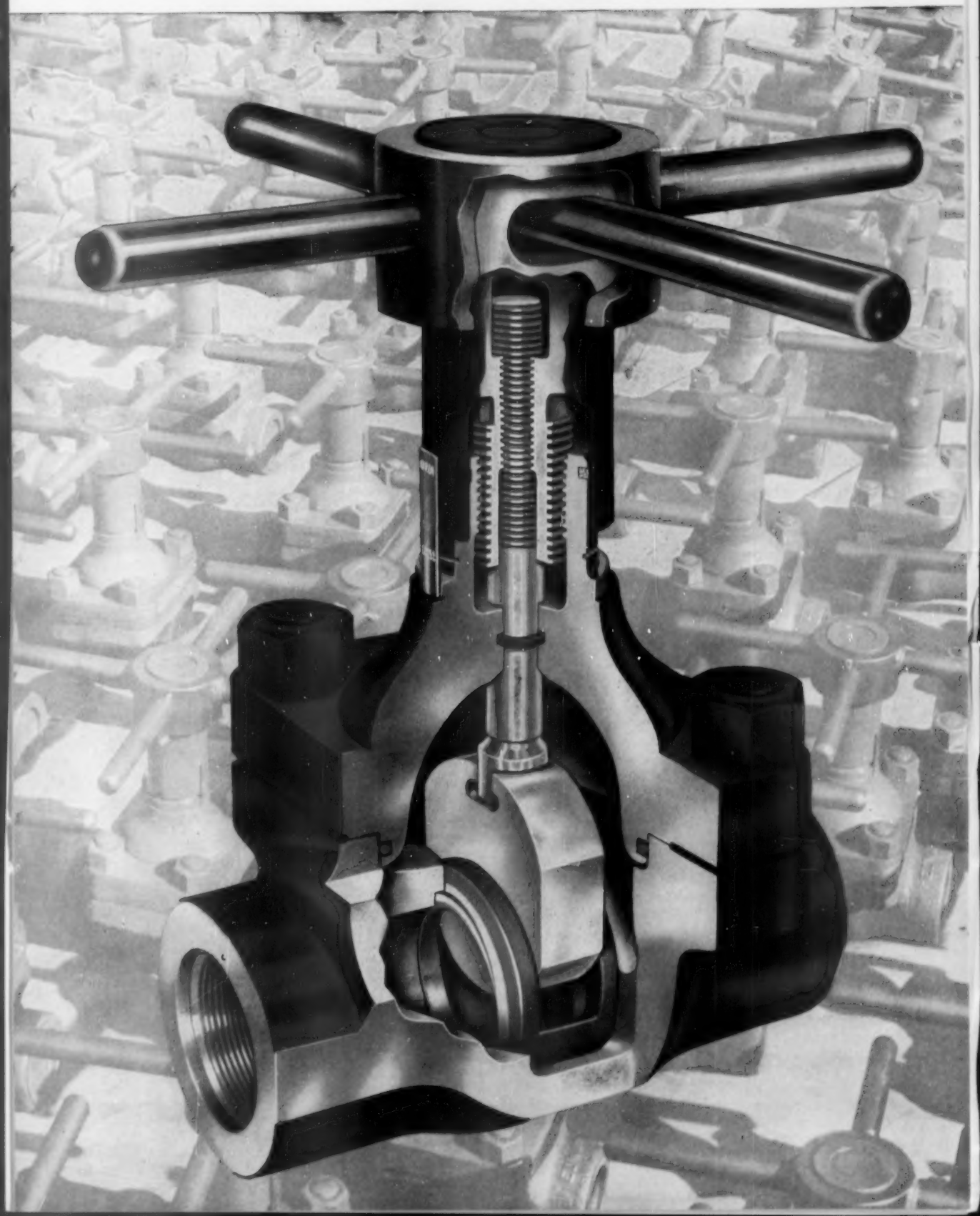

WILDCAT COMPLETIONS

Nueces Land & Livestock, D. B. Bryden Sur. 230, A-82. Dry. TD 1,760 ft.

Wymore Oil Co. and E. E. Grimes 1 Hubberd, SK&K Sur. 141, A-399. Dry. TD 5,700 ft.

Medina County: Charles Pegg 1 Carter, Jacob Huff Sur. Dry. TD 1,100 ft.

District 4

Aransas County: Heep Oil Corp. et al 2 Roquette et al, Lot 8, C. B. Lucas Subd. 1, Puerto Bay Lands, J. G. Smith Sur., A-239. IP 211 BOPD, 10/64-in., 42°, perforations 8,831-34 ft. TD 9,180 ft. (New pay in West Rockport field.)

Duval County: Hal Lee Oil Co. 2 Peters, GB&CNG Sur. 29, Certificate 118. IPP 47.84 BOPD (net), 21°, open hole 1,865-86 ft. TD 1,886 ft. (Extends Rancho Solo field.)

Kenedy County: Humble Oil & Refining Co. 4 Armstrong, Barreta Grant, A-13. IP 38 BOPD, ⅛-in., 35.9°, perforations 7,655-67 ft. TD 12,123 ft. (New field.)

Kleberg County: W. Earl Rowe 1 Bareis, Lot 16, Block 28, Kleberg Town & Improvement Co. Subd. (10 miles southeast of Kingsville). Dry. TD 7,615 ft.

Sun Oil Co. 1-B Dunn-McCampbell. Tovar Sections, Padre Island. Dry. TD 7,733 ft.

San Patricio County: H. H. Howell & William H. Winn 2 Luther et al, Mathis Land & Town Subd. 12 (3 miles northwest of Mathis). IP 57 BOPD, (net), ⅛-in. choke, 22.8°, perforations 4,217-20 ft. TD 4,238 ft. (New field—Luther.)

Starr County: Ammco Oil Co. 1 Gutierrez et al, Survey 767. Dry. TD 5,128 ft.

David Lee Hill 1 Marguerita Gutierrez, Share 14, Sur. 767. Dry. TD 1,071 ft.

Willacy County: Superior Oil Co. 3 Yturria, San Juan de Carricitos Sur., A-8. IP 121.44 BOPD, 9/64-in., 42.1°, perforations 6,526-32 ft. TD 7,700 ft. (New pay in La Sara field.)

TEXAS GULF COAST

District 2

Calhoun County: Arnold O. Morgan 1 Welder et al, Sections 6 and 7, Block D, Calhoun County Cattle Co. Subd., Port O'Connor Pasture. Dry. TD 6,215 ft.

Karnes County: Ernest J. Biskamp 2 Ed Franklin estate, Don Erasmo Seguin Grant, A-10. Dry. TD 4,022 ft.

Live Oak County: W. H. Doran, Jr. et al 1 Freeborn, C. N. Rideway Sur., A-102 (Southwest Ramierena area). Dry. TD 6,037 ft.

District 3

Brazoria County: Ralph E. Fair 1 Lipic, Lot 28, Thomas Spraggins Sur., A-366. Dry. TD 5,065 ft.

J. S. Michael, Holly Development Co. et al 1 Texas Gulf, HT&B Sur. 42, A-558. Dry. TD 9,154 ft.

Liberty County: American Republics Corp. and Houston Oil Co. of Texas 1 Phoenix Development, Jesse Devore Sur., A-23 (Hull area). Dry. TD 7,847 ft.

Matagorda County: Magnolia Petroleum Co. 8 Cornelius, J. C. Peyton Sur., A-74. IP 370 BOPD, 18/64-in., 49.5°, Frio 10,282-89 ft. TD 12,516 ft. (New pay in Wadsworth field.)

Orange County: S. E. Gilbert 1 East Beaumont, Nancy Davis Sur. Dry. TD 8,003 ft.

Waller County: Falcon Seaboard Drilling Co. 1 Young, John Irons Sur., A-59. Dry. TD 7,727 ft.

Carnes W. Weaver 1 Steggar, Andrew McStee Sur., A-220. Dry. TD 6,193 ft.

EAST TEXAS

Anderson County: Douglas & Grelling 1 Royall National Bank, Wm. Elliott Sur., A-19. Dry. TD 5,454 ft.

Miller & Walker 1 Coble, C. S. Garrett Sur., A-320. Dry. TD 5,819 ft.

David T. Roche 1 Martin, A. E. McClure Sur., A-541. Dry. TD 5,308 ft.

Houston County: Jaguar Oil Co. 1 Lula Holcomb-Jaguar Oil Co., Daniel McLean Sur., A-57. Dry. TD 5,843 ft.

Kaufman County: H. L. Hunt 1 Sowell, Absolom Hyer Sur., A-203. Dry. TD 5,013 ft.

TEXAS PANHANDLE

Hutchinson County: Phillips Petroleum Co. 1 Amethyst, Sec. 39, Block Z, EL&RR Sur. Dry. TD 8,222 ft.

WEST CENTRAL TEXAS

Callahan County: Bridwell Oil Co. 1 Osborn, Sec. 62, BBB&C Sur. Dry. TD 3,891 ft.

Neaves Petroleum Development Co. 3-A Jackson, Sec. 16, ETRR Sur. Dry. TD 1,323 ft.

H. L. Neeb 1 Crawford, 3-1-SPRR. Dry. TD 2,078 ft.

Roberts Manufacturing Co. 1 Wilson, Blk. 61, Comal CSL Sur. 181. Dry. TD 1,545 ft.

Coleman County: H. A. Birdwell & Son Drilling Co. 1 Riley, M. D. J. Trevino Sur. 669. Dry. TD 2,683 ft.

Binkerhoff Drilling Co. 1-B Beck, Sec. 132, GH&H Sur. Dry. TD 3,040 ft.

Cree Oil & Exploration Co. 1-H Owen, L. H. McNeil Sur. 230. Dry. TD 2,980 ft.

H & R Drilling Co. 1 Texas Sand Co.,

Photo — Courtesy of The French Line

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Ask the Texas Employers representative nearest you to show you more of these letters, as proof of what Texas' largest writer of Workmen's Compensation Insurance can do for you.

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"The service rendered by your office, and particularly the engineering and claims staff, has been most helpful in bringing about this reduction in our insurance costs. This type of service is unique with your company, and we are glad to pass this good word along so that other employers may benefit as we have. We can also attribute the low accident record to our regular meetings with our employees. At each of these meetings, we impress the importance of being careful and watching out for hazards and danger spots in the plant.

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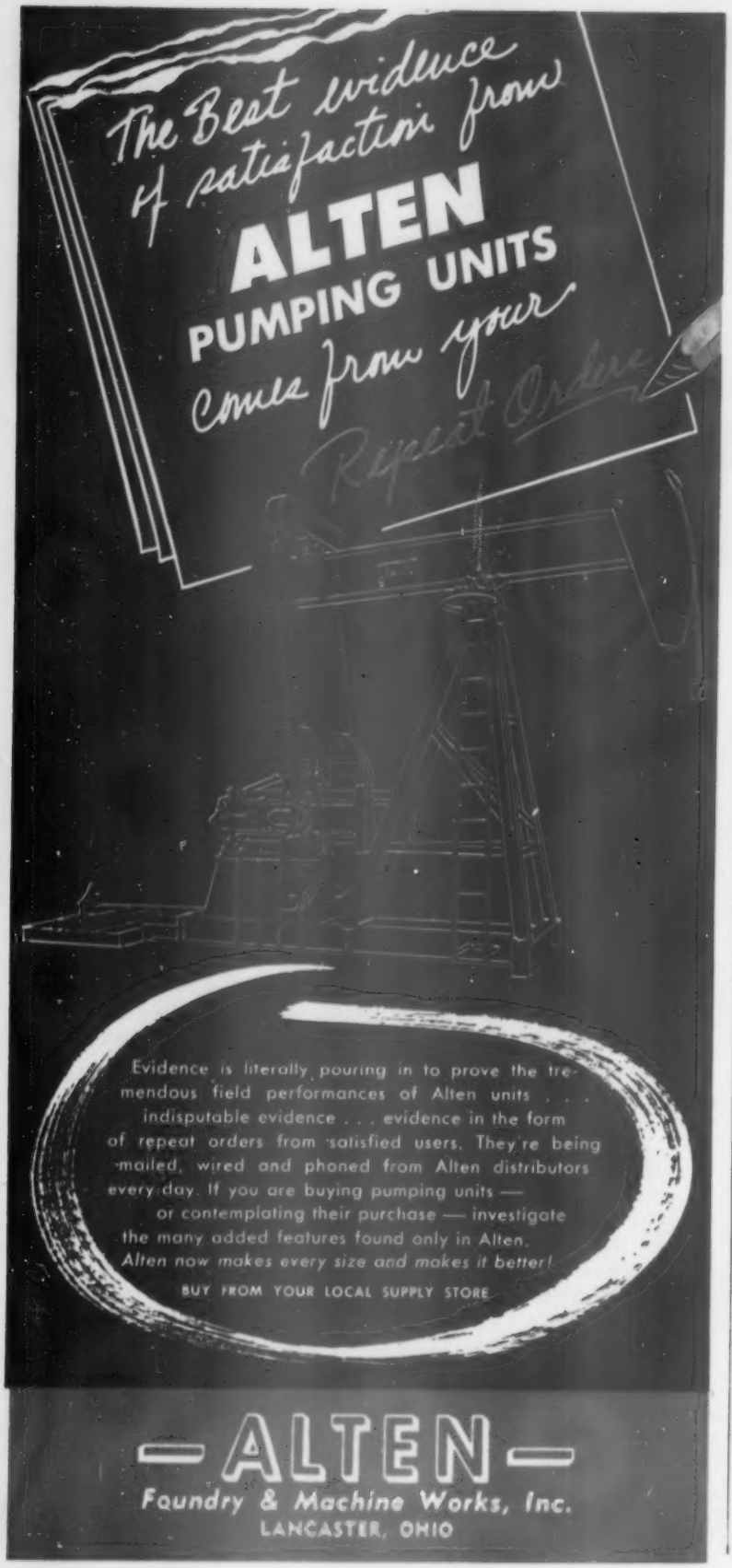
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WILDCAT COMPLETIONS

G. W. Mahoney Sur. 6. Dry. TD 2,226 ft.
Jess Hickey Oil Corp. 1 Harris, J. W. Foster Sur. 73. Dry. TD 1,560 ft.
Jerome-McLester 1 Watson, Coleman CSL Sur. 57. Dry. TD 2,127 ft.
Miller & Banks 1 Thompson, Blk. 2, A. Quigley Sur. 739. Dry. TD 2,368 ft.
Plymouth Oil Co. 1 Sealy & Smith Foundation, 29-2-GH&H, 9 miles NW Coleman. IP estimated 3,000 M.f.g., Morris sand 2,600-10 ft. TD 3,148 ft.
Warren D. Sorrells 2 Stevens, 54-2-GH&H, 4 miles N Silver Valley. IP 7,000 M.f.g., open 2-in., Morris sand 2,961-64 ft. TD 3,567 ft.

Eastland County: McClung & West 1 Weiser, Sec. 64, H&TC. Dry. TD 1,325 ft.

Jones County: Belcher Trust 1 Hawthorne, J. W. McKissick Sur. 204. Dry. TD 2,600 ft.
Belcher Trust 2 Hawthorne, J. W. McKissick Sur. 204. Dry. TD 3,005 ft.
L. A. Hedrick 1 Winter, 37-17-T&P. Dry. TD 2,653 ft.
N. B. Hunt 1 Hauk, 67-1-BBB&C. Dry. TD 4,670 ft.
R H K Drilling Co. 1-A Winter, 19-19-T&P, 6 miles N Trent. IP 98 BOPD, 15/64-in., 41°, Swastika sand 3,080 ft., TP 50 psi., GOR 200 cu. ft. TD 3,087 ft.

Palo Pinto County: Lance-Tucker 1 Milling, J. W. Tipton Sur., A-1122. Dry. TD 2,620 ft.

NORTH TEXAS

Archer County: Ada Oil Co. 1 Frerich, 71-3-Clark & Plumb Sur. Dry. TD 4,640 ft.
Bolin Oil Co. 1 Threat, Blk. 92, Jefferson CSL. Dry. TD 1,082 ft.
Bridwell Oil Co. 21 Bridwell River Ranch, J. Huddleston Sur., A-1075. Dry. TD 5,523 ft.
J. D. Burkett 2 Harmonson, J. B. Hinds Sur., A-183, 12 miles SE Archer City. IPP 20 BOPD, pay 837 ft. TD 840 ft.
Double L Drilling Co. 2 Gore, TE&L Sur., A-521. Dry. TD 1,025 ft.
Double L Drilling 3 Gore, TE&L Sur., 1837. Dry. TD 1,046 ft.
Presley & Presley 1 Seay, Blk. 56, Harris Subd., 8 miles NW Archer City. IPP 30 BOPD, 34°, pay 1,147-60 ft. TD 1,195 ft.

Clay County: L. T. Burns 1 Baxter, J. H. Milray Sur., A-313. Dry. TD 4,764 ft.
L. T. Burns 1-A Holt, W. W. Yearly Sur., A-745, 2½ miles W Deer Creek. IPP 91 BOPD, 42°, perforated 3,257-61 ft. TD 4,555 ft.

Jack County: Wright, Clark & Senkel, Inc. 1-B Walden, A. S. Ensworth Sur., A-1789, 3 miles SW Bryson. IPP 41 BOPD, sand pay 2,807-12 ft. TD 4,473 ft.

Knox County: Rowan & Hope 1 Steinboch, Blk. 9, D. G. Burnett Sur. 20. Dry. TD 5,207 ft.

WEST TEXAS

Borden County: James G. Brown & Associates 1 Bacon, 49-25-H&TC. Dry. TD 7,230 ft. Elev. 2,404 ft., reef 7,220 ft.

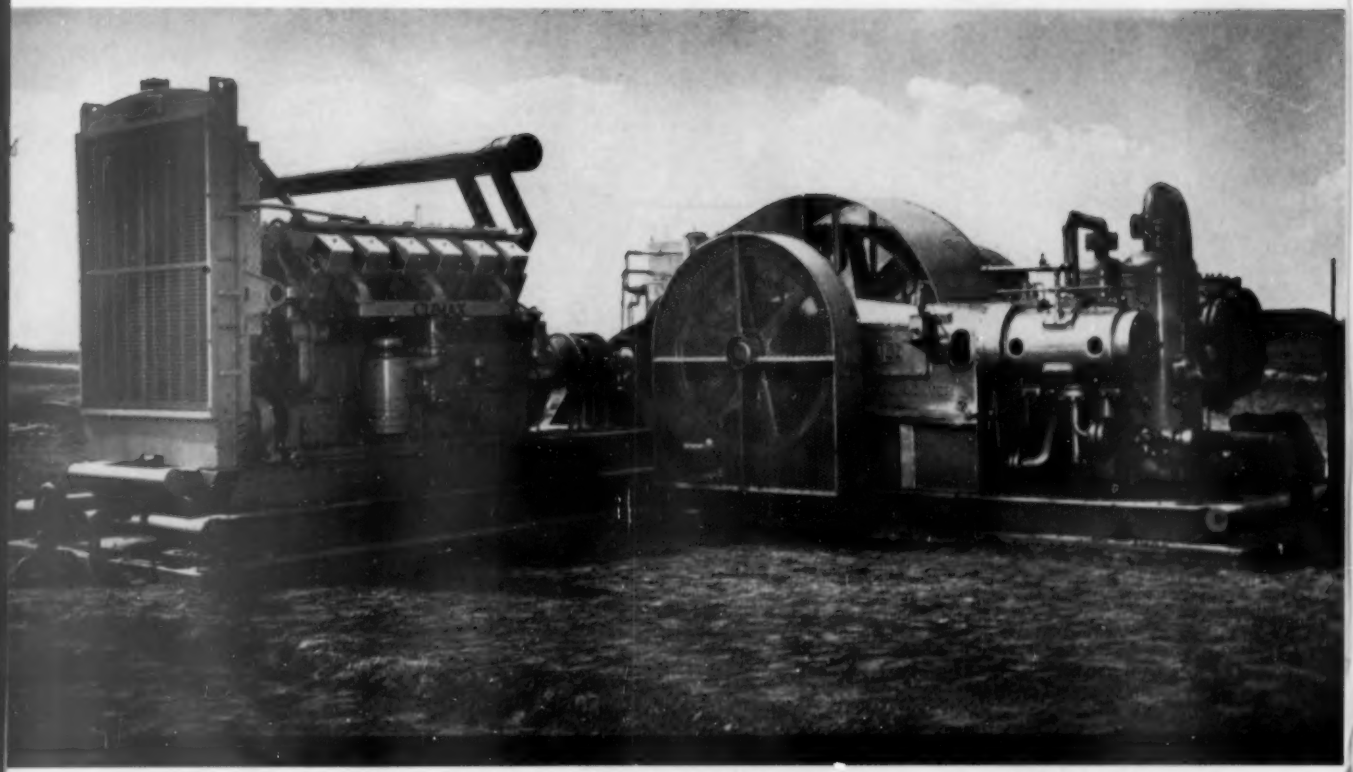
Crockett County: J. B. Randle 1 Luckett, 62-GH-GC&SF. Dry. TD 1,454 ft.

Garza County: O'Neal Drilling Co. 1 Connell, 58-5-GH&H. Dry. TD 3,509 ft.

Hockley County: Stanolind Oil & Gas Co. 1-A Sosebee, 64-12-Donley CSL. Dry. TD 10,500 ft. Elev. 3,395 ft., Wolfcamp 8,400 ft., Pennsylvanian 10,108 ft.

Midland County: British-American Oil Producing Co. 1 Roy Parks, 28-41-T2S-T&P, 3 miles E Odessa. IP 739 BOPD, 14/64-in., 55.3°, TP 1,825 psi., GOR 1,189 cu. ft., Ellenburger perforations 13,044-13,182 ft. TD 13,350 ft.

Rugged Performance



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This Climax engine operates at 1030 RPM, driving a Gardner Denver 13" compressor at 260 RPM, intake pressure 15#, first stage 130#, second stage 760#. Production is approximately 1,250,000 cubic feet of gas per day.

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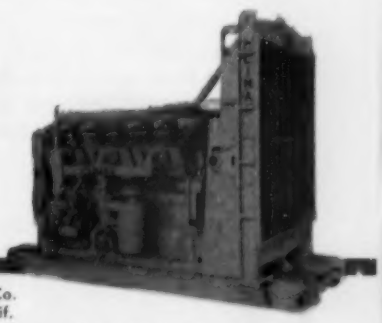

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Widely recognized in drilling operations for effective correction and prevention of lost circulation—Palco Seal is now available in loose-filled 40-lb. bags, and in popular compressed 80-lb. bales . . .

Ease of handling, rapid uniform dispersal, lasting suspension, fast caulking seal, and non-deterioration are the qualities which have put Palco Seal at the top of the list with experienced mud engineers, drillers and toolpushers. Palco Seal is an *engineered* product of research, combining long and short fibers of controlled length and size—carefully manufactured from an ideal basic raw material. Like redwood from which it is derived, Palco Seal is inherently resistant to decay or chemical deterioration. Wherever porous or thief formations occur, it quickly sets up a densely matted barrier of tightly interlocked fibers which stay put for more effective and permanent control of circulation loss. Complete dispersal means that it's always where it's needed. Low cost and lasting suspension contribute to initial and sustained economy. Application experience for over a decade gives assurance of more effective prevention and control of mud losses. Specify Palco Seal in the new 40-lb. loose-filled bags for ease of handling—or standard compact compressed 80-lb. bales.

Write for Bulletin No. 4-02 describing the properties, operating advantages, and composition of Palco Seal.

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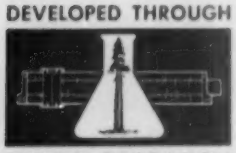

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WILDCAT COMPLETIONS

Schleicher County: Ada Oil Co. 1 Reynolds, 57-1-GH&SA. Dry. TD 5,480 ft.

Dalton H. Cobb 1 Brown, 71-1-GH&SA. Dry. TD 6,320 ft.

Sutton County: Travis Drillers, Inc. 1 Mayfield, Sec. 1, Idabell Landrum Sur. Dry. TD 4,980 ft. Elev. 2,271 ft., Wolfcamp 2,770 ft., Pennsylvanian shale 2,985 ft., Canyon sand 3,420 ft., Ellenburger 4,620 ft.

WEST TEXAS BORDER COUNTIES

Coke County: LaGloria Oil & Gas Co. and Dykes Drilling Co. 1 Reed, 3-2-GC&SF. Dry. TD 6,779 ft.

Fisher County: General Crude Oil Co. 1 Davenport, 217-3-H&TC. Dry. TD 7,552 ft. in Cambrian sand.

A. V. Jones & Son 1 Rains, Sec. 280, H&TC Sur. Dry. TD 4,108 ft.

NORTHERN NEW MEXICO

Rio Arriba County: U. S. Smelting, Refining & Mining 1-138, Jicarilla, NW NW SE 7-23n-3w. Dry. TD 8,560 ft. Entrada.

KENTUCKY

Hopkins County: Walton & Pledger 1 Cates, SW NE SW 10-K-22. Dry. TD 2,660 ft.

McLean County: Ashland Oil & Refining Co. 1 Ashland-Yunker, SW SW NE 21-L-26. Dry. TD 2,698 ft.

MICHIGAN

Oceana County: J. V. Wicklund, Jr. 1 Clemens, NW NW NE 1-15n-15w. Dry. TD 2,730 ft. in Dundee.

Washtenaw County: Ford Henry 1 Boyce, NE SE SW 35-4s-4e. Dry. TD 800 ft. in Dundee.

WEST VIRGINIA

Braxton County, Otter district, Otter Gas Co. 1 Hugh Beckett, elevation 923 ft. Dry. Onondaga 6,500-6,650 ft., Oriskany sand 6,674 ft., show of gas, TD 6,725 ft.

Randolph County: Randolph Gas Co. 2 King & Avington, elevation 2,512 ft., gas 2,210 ft., TD 2,156 ft.

FLORIDA

Hendry County: Humble Oil & Refining Co. 1 Consolidated, SE SE 5-45s-29e. Dry. TD 2,647 ft. (Unable to recover circulation.)

ALABAMA

Clarke County: I. P. La Rue and L. B. Herring 1 Tensaw, 36-6n-1e. Dry. TD 7,494 ft. Elev. 37 ft., lower Tuscaloosa 7,245 ft.

MISSISSIPPI

Jefferson County: Calto Oil Co. 1 Louis Guidon heirs, 23-9n-2w. Dry. TD 6,111 ft. Elev. 175 ft., Wilcox 3,730 ft., Artman 5,423 ft., Pearline 5,468 ft.

T. J. Glennon 1 Truly, 21-8n-1e. Dry. TD 6,508 ft. Elev. 239 ft., Wilcox 3,840 ft., base Baker shale 5,694 ft.

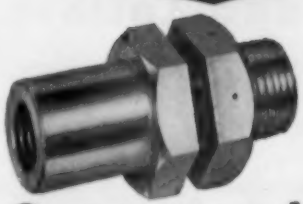
Perry County: Larco Drilling Co. 1 Ross, NE NW 14-1s-10w. Dry. TD 9,005 ft. Elev. 160 ft., lower Tuscaloosa 8,594 ft., Massive 8,890 ft.

Union County: Gulf Refining Co. 1 Basden et al, NE SE 20-7s-5e. Dry. TD 5,010 ft. Elev. 365 ft. (estimated), Silurian 1,310 ft., Ordovician 1,443 ft., Knox 4,185 ft.

Yazoo County: Tip Ray and D. C. Latimer 1 Anthony, 15-12n-2e. Dry. TD 8,011 ft. Elev. 258 ft., Lower Cretaceous 6,490 ft.

Now Available!

DEUBLIN Quick-Release VALVE



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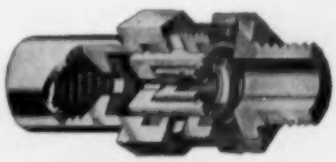

2⅛" over-all length; weight, 1½ ounces.

Advanced engineering and performance features make this Deublin unit outstanding.

- ✓ **It is guaranteed *not* to CHATTER.**
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- ✓ **Double-piston design assures smooth, positive, quick releasing action.**

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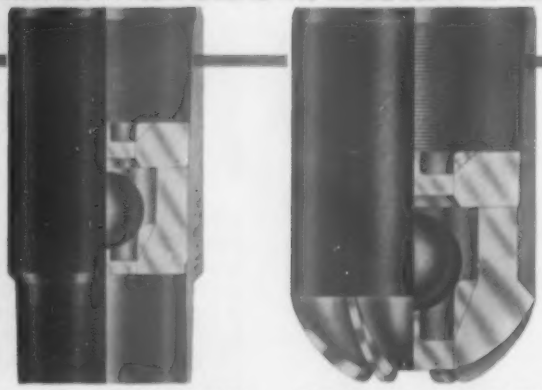

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WILDCAT COMPLETIONS

NORTH LOUISIANA

Concordia Parish: Serio-Punches Oil Co. and E. C. Wentworth 1 Harris, 18-6n-9e. Dry. TD 7,021 ft.

Franklin Parish: Shell Oil Co. 1 Snyder et al, C NE NE 12-13n-8e. State test. Dry. TD 7,231 ft.

Webster Parish: Cotton Valley Operators Committee 1 Hunt-Gaines, C NW NE 30-21n-9w. IPF 105 BOPD, 13/64-in., 57.5°, GOR 1,549:1, Justiss 8,981-95 and 9,056-64 ft. TD 9,150 ft. (Discovery new Justiss sand area in Cotton Valley field). OWDD.

ARKANSAS

Chicot County: H. L. Hawkins and F. S. Kelly, Jr. 1 Meyers, C NE 3-19s-1w. Dry. TD 1,682 ft.

Miller County: Larry C. Mills 1 Lowe, 24-15s-26w. Dry. TD 2,845 ft.

Pan American Production Co. 1 Holmes Unit, C SW NE 1-20s-27w. Dry. TD 6,965 ft.

OKLAHOMA

Comanche County: Noel Carbaugh 1 Doyle, NE SE SE 6-4n-11w. Dry. TD 2,001 ft.

Grady County: Max Pray 1 Billy, C SE NE 4-4n-5w. IPF 172 BOPD, Cunningham 9,890-9,943 ft., 34.5°, ¼-in. TD 10,660 ft. (Oil discovery.)

Frankfort Oil Co. 1 Crittenden, NE NW SE 19-4n-7w. Dry. TD 3,990 ft.

Phillips Petroleum Co. 1 Apatite, C SE SE 28-5n-5w. Dry. TD 11,398 ft.

Le Flore County: Le Flore County Gas & Electric Co. 1 Darnell, W½ NW SE 18-9n-27e. IP 10,000 M.c.f. of gas per day, Spiro 6,206-6,308 ft. TD 6,435 ft. (Gas discovery.)

Lincoln County: Rocket Drilling Co. 2 Oberman, SE SE SW 22-12n-2e. Dry. TD 5,910 ft.

Noble County: Sterling Oil Co. of Oklahoma 1 Johnson, NW NW SE 31-20n-1w. Dry. TD 4,336 ft.

Sterling L Ryarson, SE NE NW 31-20n-1w. Dry. TD 5,059 ft.

Okfuskee County: Jones, Shelburn & Pellow 1 Fleming, NW NE SE 4-10n-11e. IPF 155 BOPD, first Wilcox 3,676-97 ft., 42°, ½-in. TD 3,697 ft. (Oil discovery.)

Champlin Refining Co. 1 Shepard, SW SW NE 2-12n-10e. Dry. TD 3,571 ft.

Oklahoma County: Wilcox & Henry 1 Anderson, NW NW SW 19-14n-1w. Dry. TD 6,163 ft.

Wilcox & Henry 1 Mason, NW NE SW 24-14n-2w. Dry. TD 6,152 ft.

Peppers Petroleum Co. 1 Dahl, NW SW NE 33-14n-3w. Dry. TD 6,883 ft.

Payne County: Earl Wells 1 Harrison, SW NE NW 18-17n-2e. Dry. TD 4,395 ft.

Seminole County: Skelly Oil Co. 1 Orwig, SE SW NE 8-9n-8e. Dry. TD 3,895 ft.

KANSAS

Edwards County: Gramehart-Miller 1 Butler, NE NE SW 35-25s-18w. Dry. TD 5,074 ft.

Ellis County: Lauck 1 Keagy "B," SW SW NE 32-11s-20w. Dry. TD 4,351 ft.

Harvey County: Herndon Drilling Co. 1 Worthington, SW NW NW 13-24s-2e. Dry. TD 3,387 ft.

Kiowa County: Aladdin Petroleum Corp. 1 Johansen, C SE SE 13-28s-19w. IP 1,000 M.c.f. of gas per day, Miss. 4,860-90 ft. TD 5,510 ft. (Gas discovery.)

Lyon County: Nemaha Oil Co. 1 Rathke, C NE NE 21-21s-10e. Dry. TD 2,770 ft.

Russell County: Veeder Supply Co. 1 Moch-

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WILDCAT COMPLETIONS

lin, NW NW NW 9-13s-14w. Dry. TD 3,250 ft.

Thomas County: Derby Oil Co.-Van Grisso 1 Kistler, SE SE SE 34-9s-34w. Dry. TD 4,960 ft.

Pawnee County: Welch & Olsson 1 Steffen, SE NW SE 8-21s-20w. Dry. TD 4,558 ft.

Musgrove Petroleum Co. 1 Smith "C," SW SW SE 17-22s-15w. Dry. TD 4,065 ft.

Stafford County: Natural Gas & Oil Corp. 1 DeBusk, SW SE NE 29-24s-14w. Dry. TD 4,365 ft.

NEBRASKA

Banner County: Lubar Oil Co. 1 Cross, SE SE SE 3-18n-56w. Dry. TD 6,121 ft.

Cheyenne County, Woten: Gem Oil Co. 1 Woten, NE NE NW 29-16n-52w. IPP 140 BOPD, "J" sand discovery, new field. TD 5,490 ft.

Miracle-Fifer 1 Thomas, NE NE NW 3-13n-51w. Dry. TD 5,060 ft.

Red Willow County: Kay Oil Co. 1 Moyer, NW NW NW 33-1n-27w. Dry. TD 3,641 ft. granite.

Rothmeier, Betts & Sauvage 1 Randel, SE SE NE 27-1n-29w. Dry. TD 4,210 ft. granite.

NORTH DAKOTA

Dunn County: Mobil Producing Co. F-32-24-P Kennedy, SW NE 24-149n-93w. Dry. TD 11,331 ft. Souris River.

Sheridan County: Caroline Hunt Trust Estate 1 Bauer, SW SW 19-146n-76w. Dry. TD 7,135 ft. Winnipeg.

Stutsman County: Calvert Exploration 1 Ganser, NW SW 12-140n-67w. Dry. TD 3,989 ft. Granite.

CALIFORNIA

Fresno County: Lane Pet Co. 26-29 Benadom, 29-17s-19e, Temblor 5,919 ft. Suspended. TD 8,666 ft.

Kern County: Ferguson & Bosworth 1 P. W. McClennen, 7-30s-21e, Phacoides 2,990 ft. Dry. TD 3,045 ft.

Ruby Oil Co. 17 Quinn, 17-25s-27e, Vedder 3,320 ft., basement 3,920 ft. Dry. TD 3,932 ft.

The Texas Co. 1 KCL Parallel, 36-28s-24e. Dry. TD 10,986 ft.

Intex Oil Co. 76-28 Intex-KCL, 28-30s-26e, Stevens 8,208 ft. Dry. TD 8,339 ft.

San Luis Obispo County: Aeco Corp. 1 Aeco British-American-Shell, 13-11n-28w. Dibblee 5,200 ft. Dry. TD 6,629 ft.

The Texas Co. 1 KCL Traver, 12-11n-26w. Dry. TD 5,999 ft.

Santa Barbara County: Richfield Oil Corp. 112-6 Hibberd, NE NE 6-9n-26w. IPF 372 BOPD rate, 14/64-in. choke, 26.6° gravity, 25 M.c.f. gas, perfs. 2,046-2,101 ft. in Santa Margarita sand, TD 2,222 ft. (New shallow oil pool in South Cuyama field.)

Tulare County: Agoil Co. 1 Agoil, 28-16s-23e. Suspended. TD 3,333 ft.

Ventura County: Amerada Petroleum Corp. 1 Wadleigh, 30-4n-23w. Suspended. TD 3,413 ft.

Yolo County: Monterey Oil Co. 1 Clover, 19-11n-1e. Dry. TD 5,350 ft.

MONTANA

Blaine County: Tide Water 1 Unruh, NE NW SE 32-36n-19e. Dry. TD 4,267 ft. Mission Canyon.

Liberty County, South Chester: Amerada Petroleum Corp. 1 Skierka, C N½ NE SE 2-28n-6e. Dry. TD 2,705 ft. Madison.

Amerada 3 Kolstad, C NW NW 3-31n-4e. Dry. TD 2,328 ft. Madison.

NEVADA

Elko County, Thousand Springs: Gulf Oil Corp. 1 Government, SE SW 8-40n-66e. Dry. TD 8,412 ft.

Wells area: Gulf 1 Wilkins Ranch, NE NE NE 21-38n-61e. Dry. TD 8,414 ft.

South Deeth: Gulf 1 Peter Itceina, SE NW 3-37n-59e. Dry. TD 5,465 ft.

WYOMING

Converse County, Big Muddy: Natural Gas & Oil Corp. 1 Anderson-Government, C SE SE 27-33n-77w. Dry. TD 4,918 ft. Lakota.

Hot Springs County, Prospect Creek: Husky Oil 1 Cottonwood Land & Coal Co., SW NW NW 26-45n-98w. Dry. TD 6,426 ft. Tensleep.

Johnson County, Murphy Creek: Wyomont Drilling Co. 1 Government, NE NE NE 25-42n-82w. Dry. TD 1,658 ft. Alcova.

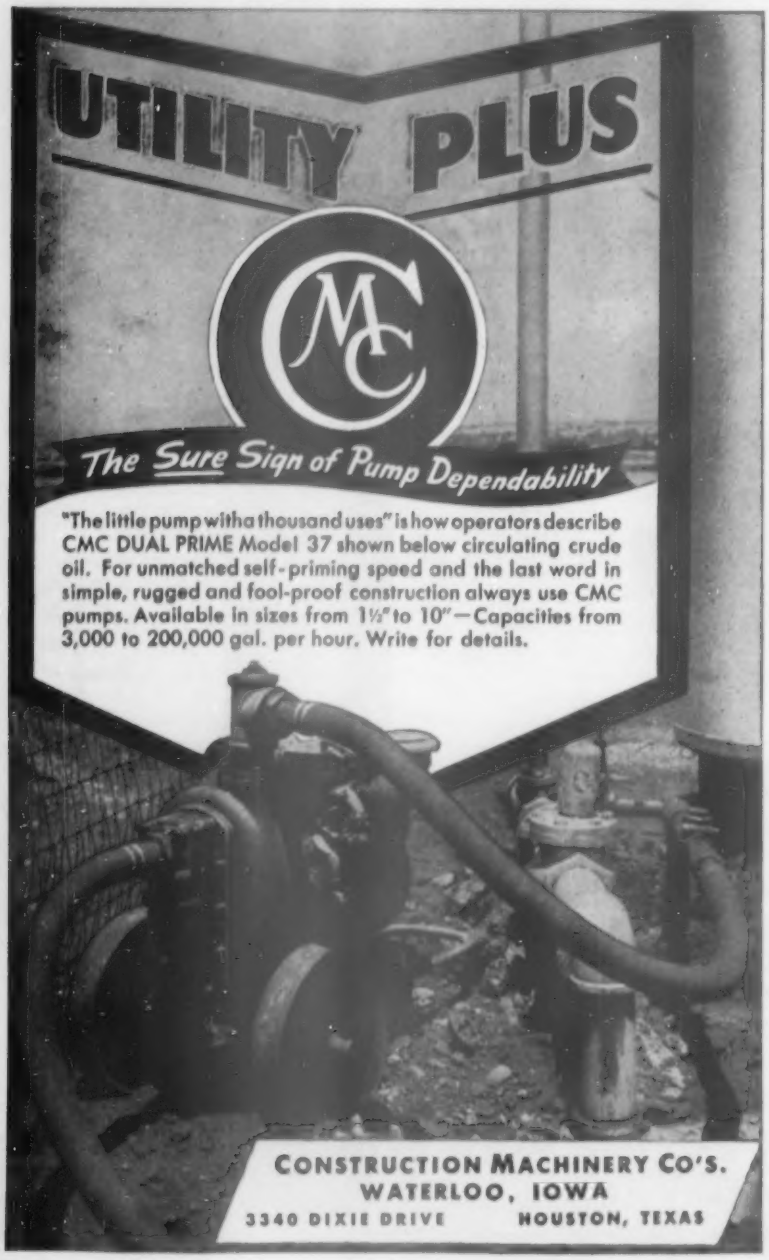
Sheridan County, Decker area: Shell Oil Co. 1 Hallworth, C NE NE 31-58n-84w. IPP 260 BOPD, Ash Creek discovery, new field. TD 4,960 ft. Ash Creek.

COLORADO

Adams County: Vaughey & Vaughey 1 Gooch, NW NW NW 35-2s-58w. Dry. TD 5,950 ft.

Baca County, Stonington: Carter Oil Co. 1 Schweizer, SW SW NE 9-31s-43w. Dry. TD 5,650 ft. St. Genevieve.

Larimer County, Timnath area: J. Ray McDermott, B. F. Allison, T. W. and J. M. Loffland, Jr. 1 Hummel, C NE SW 3-6n-68w. Dry. TD 7,930 ft. lower Satanka.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WILDCAT COMPLETIONS

Logan County: Petroleum, Inc. 1 Good, SW SW SE 13-9n-54w. Dry. TD 5,190 ft.

Morgan County: B. F. Allison 1 Eriksen, NW NE SW 18-4n-56w. Dry. TD 5,545 ft.

McMahon & Bullington 1 Edwards, C SW NE 20-5n-60w. Dry. TD 6,576 ft.

1 State, C SE SW 36-5n-56w. Dry. TD 5,304 ft.

Washington County: O'Donnell & Edmondson 1 Ireland, NW NW NW 15-2n-54w. Dry. TD 4,845 ft.

Sanford, Rounds, Feldt & Robinson 1 Simpson, SW SW SW 14-1s-55w. Dry. TD 5,060 ft.

Wytex Service Corp. 1 Forbes, C SW SE 14-1n-54w. IPP 155 BOPD, "J" sand discovery, new field. TD 5,036 ft.

MANITOBA

Pathfinder and Associates 29-4 Milne, LSD 4, 29-15-26w1. Dry. TD 2,000 ft.

Great Northern-Souris Valley 16-16 Coulter, LSD 16, 16-1-27w1. Dry. TD 6,840 ft.

Sapphire 11-2 North Daly, LSD 11, 2-11-28w1. Dry. TD 2,730 ft.

Sapphire 12-36 Reaper, LSD 12, 36-11-28w1. Dry. TD 2,586 ft.

Souris Valley 2-17 Stony Creek, LSD 2, 17-6-28w1. Dry. TD 3,486 ft.

Dome-Harris-Cox 4-32 Two Creeks, LSD 4, 32-12-26w1. Dry. TD 2,307 ft.

Dome-Harris-Cox 4-4 Whitewater Lake, LSD 4, 4-4-22w1. Dry. TD 3,060 ft.

Sapphire 1 West Willen, LSD 9, 11-14-29w1. Indicated Miss. oil well. TD 2,290 ft.

SASKATCHEWAN

Texaco A14-11 Battle Creek, LSD 14, 11-5-29w3. Dry. TD 4,655 ft.

Sooner 15-25 Samuel Clarke, LSD 15, 25-3-4w2. Dry. TD 4,768 ft.

Socony-Sohio 11-14 Hatfield, LSD 14, 11-28-22w2. Dry. TD 5,270 ft.

Phillips-Husky 1 Eston, LSD 7, 29-25-30w3. Dry. TD 3,135 ft.

Shell 5-12 Viewfield, LSD 5, 12-6-10w2. Mission Canyon oil well. TD 4,730 ft.

Phillips-Husky 1 Moremac, LSD 6, 29-25-22w3. Dry. TD 3,157 ft.

Amurex 1-4 North Crane Lake, LSD 4, 32-13-23w3. Dry. TD 3,615 ft.

ALBERTA

Socony-CPR 14-7 Agatha, LSD 7, 14-14-11w4. Dry. TD 3,132 ft.

Texaco A12-2 Deville, LSD 12, 2-52-20w4. Viking gas well. TD 3,700 ft.

Shell 3 Grande Prairie Strat test, LSD 1, 10-72-5w6. Dry. TD 2,000 ft.

Calvan-Charter 9-30 Sun, LSD 9, 30-35-10w4. Viking oil well. TD 3,007 ft.

Seaboard-Canadian Superior 14-17 Hillsdown, LSD 14, 17-38-26w4. D2 oil well. TD 8,200 ft.

Anglo-Home 13-1 North Atlee, LSD 1, 13-23-7w4. Dry. TD 3,676 ft.

Imperial 6-2-37-3 Provost, LSD 6, 2-37-3w4. Viking gas well. TD 2,256 ft.

Hudson's Bay 1 Sibbald, LSD 7, 20-27-2w4. Dry. TD 2,900 ft.

Gas Blow-Out Averted In Wilson County Wildcat

A rank wildcat test being drilled by J. C. McCabe 9 miles west of Floresville, in Wilson County, Southwest Texas, encountered a strong gas blow while a drill-stem test was being attemepted in Austin chalk at 5,700 ft. The well, which tried to blow out, was brought under control by heavy mud pumped into the hole over a period of about 12 hours. The wildcat is 1 J. S. Bynum. Location is in the J. W. McCullough Survey.

West Polo In Oklahoma Gets Crews Sand New Pay

A Crews sand new-pay discovery is reported for West Polo pool in northern Oklahoma's Noble County. The strike is T. O. Lilystrand 1-A Freese, NE NE SE 20-22n-2w.

The flowing well made oil at the rate of 5 bbl. per hour through varying chokes from 16/64 to 20/64-in. Perforations are at 2,011-20 ft. This Noble County pool originally had Misener sand production. The pay was fractured. Earlier tests showed a rate of flow of 22 bbl. hourly through ¼-in. choke.

Dora Roberts Ranch Offset Recovers Mud on DST

Forest Oil Corp. and Cities Service Oil Co. 2 Dora Roberts "C-4," a northeast offset to the same operators' 1 Roberts, first Ellenburger producer on Ranch lands in southwestern Midland County, West Texas, has encountered mud with no shows on preliminary tests of the Ellenburger.

This well entered the Ellenburger at 13,250 ft., minus 10,338 ft., which makes it 167 ft. low on structure to 1 Roberts "C-4." Drill-stem tests in 2 Roberts were started at 13,238 ft., and with the exception of the interval at 13,368-13,380 ft. which developed 5 ft. of gas-cut mud, there have been no shows of oil or gas to 13,455 ft., total depth at this

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writing. At last report operators had set packer at 13,103 ft. and were acidizing before making further tests.

Seminole, Oklahoma, Wildcat Has Production Tests Due

A Seminole County wildcat in east-central Oklahoma is due production tests. It is Amarillo Oil Co. and Seneca Oil Co. 1 Harber in SW NE NE 6-10n-6e.

The operators will test in the Earlsboro sand after plugging back. The wildcat tested no shows in the Wilcox sand. An Earlsboro sand drill-stem test at 3,631-40 ft. recovered 180 ft. of oil and gas-cut mud. Shut-in pressure was 1,440 psi. The discovery prospect is 1 mile northwest of Northeast Little pool.

New Sand Produces In Discovery at Lirette

A new-pay discovery has been made by Humble Oil & Refining Co. on the northeast side of Lirette gas field, in Terrebonne Parish, Louisiana Gulf Coast.

The discovery well, 7 Ellender, in 23-19s-19e, produced at the rate of 2,438,000 cu. ft. of gas and 7.44 bbl. of 49.1°-gravity condensate per day through ¼-in. choke with pressure of 2,275 psi.

Pay zone is in Miocene sand with casing perforated at 5,764-78 ft. Hole had been drilled to 11,700 ft., and has casing to 9,806 ft.

Two New Grady, Oklahoma, Pools Step Up Development

A 12,400-ft. wildcat is scheduled for the North Bradley pool area in Grady County, western Oklahoma. It is Atlantic Refining Co. 1 Walter J. Welch, SE NW 14-5n-5w. It is ½ mile west and one location north of Gulf Oil Corp. et al 1 Costello, recent deep discovery in C NE SE 14-5n-5w.

A try for confirmation to Northwest Chitwood pool, also in Grady County, is announced by Magnolia Petroleum Co. at a 11,500-ft. test, the 1 E. D. Johnson in C NW NW 19-5n-6w. It will be the south offset to the field discovery well, McCurdy and E. R. Bahan 1 Bowen, C SW SW 18.

Linkup Well In Bethel Area Of Oklahoma Testing Booch

A mid-way well between Bethel and West Bethel pools in 12-9n-7e, Oklahoma, is flowing about 2 bbl. of new oil hourly on ¾-in. choke from open hole in the Booch sand.

Russell Cobb, Jr., and Crain & Deisenroth 1 McMahan, NE NW SE 12, is about ½ mile from production in both the above named pools. Testing continues.

Headlee Pool Extension Flows 727 Bbl. on Completion

British-American Oil Producing Co. 1 Roy Parks "B," SE SW 16-41-T2S-T&P, Ector County, West Texas, 4 miles east of Odessa and an eastern extension to Headlee-Ellenburger field, has been completed for 727.26 bbl. of oil. Production is from perforations in the Ellenburger at 13,198-13,228, 13,254-13,270 and 13,290-13,310 ft. The gage was through 16/64-in. choke, with flowing tubing pressure of 1,450 psi. and gas-oil ratio of 1,079 cu. ft. Top of the Ellenburger was 13,225 ft. on ground elevation of 2,872 ft.

Exploration Wins

Geologist Curran back in field he left for $50 raise

ROBERT B. CURRAN, president of Canadian British Empire Oil Co., Ltd., Calgary, left his chosen profession of geology in the mid-thirties for a $50 a month raise. The raise led to two things—marriage and the first step in numerous oil industry promotions.

He was making about $85 a month as a junior geologist for Carter Oil Co. at Seminole when he accepted the raise. He chuckles when he recalls how the raise caused him to switch from geology to scouting, and how it enabled him to marry his wife, Jean, whom he met several years earlier while attending the University of Oklahoma.

It was the first change in a career that has made some big moves. Since that time, he has held top jobs in five oil companies — including the presidency of two. He was named president of Canadian British only last August and has acquired a new title with another firm since then.

Only last week Curran was appointed a director and chairman of the executive committee of Arrow Drilling Co., Tulsa, after Canadian British acquired controlling interest in Arrow *(see story in news section)*.

Career . . . Being short on funds was nothing new for Curran during the depression era. He took his first job in the industry in 1927, working as a roustabout to earn money for his college education. Later, he was forced to quit school for a year to take a job in a Tulsa bank to help finance the remainder of his education. He received his degree in June 1933.

Five months after graduating, Curran went to work for Carter at Seminole. It was in 1935 when he got that $50 raise and a wife. He remained with Carter until 1948, resigning as a director and vice president. During his tenure with Carter he held such posts as manager of the Rocky Mountain division and as assistant to O. C. Schorp when he was president of the firm.

After leaving Carter, he joined W. H. Barber Co., Minneapolis, as vice president and regional manager in the Rocky Mountain area. About a year later, he resigned to enter the Canadian oil scene for the first time. He became associated with Imperial Oil, Ltd., at Calgary as head of the company's western producing operations.

He remained with Imperial 3 years, leaving in 1952 to become president and managing director of Home Oil Co., Ltd., Calgary. He resigned a year later and became an independent operator at Calgary. He joined Canadian British last April.

Back to geology . . . Curran, who was born in Tulsa in 1909, is what might be classified as a double-barreled member of the industry from the standpoint of association affiliations. He holds memberships in several organizations, both Canadian and American.

Outside the industry, he takes an active interest in sports and is a member of the board of governors of the Calgary Stampeders, the city's professional football team.

Curran has made a partial switch back to geology in his job as head of Canadian British. The company is a comparative newcomer in exploration, having branched out into the field in 1952 after being primarily an investment company. The company now holds about 400,000 acres in Alberta, British Columbia, North Dakota, and Montana. Much of this land is untested. It's part of Curran's job to guide the company in exploring this land and in selecting other areas that will mean new production for the firm.

Lee Gray, former geologist with Skelly Oil Co. in Kansas and New Mexico, has resigned to join the geological staff of Canada Southern Oils, Ltd., in Calgary.

Don Allen, geologist with Westgate Oil Co. of Wichita, has resigned and is planning to open offices as a consultant in Wichita. Allen joined the old Westgate-Greenland Oil Co. in 1941 and has been associated with Westgate since 1951.

O. L. Odale has been appointed production manager of the Denver area by Shell Oil Co. Odale succeeds **J. E. Clark,** recently appointed area manager for Shell at Midland, Tex.

Joseph E. Murphy, general superintendent at Esso Standard Oil Co.'s Everett, Mass., refinery, has been assigned as general superintendent of Esso's Antwerp, Belgium, refinery. Murphy is expected to be in Antwerp for 6 months before resuming his duties at Everett. **J. E. Lyons,** assistant general superintendent at Everett, will serve as general superintendent during Murphy's leave.

J. S. Leonard has been promoted to assistant manager of the Casper, Wyo., production division by Ohio Oil Co.

J. S. LEONARD

R. E. McMILLEN

Leonard joined Ohio as a junior geologist in 1930 and has been at Sydney, Neb., as district manager since 1953. **R. E. McMillen** has been named to succeed Leonard at Sydney. McMillen joined Ohio in 1941 and served at Mount Pleasant, Mich., Grand Rapids, Tulsa, and Houston before becoming assistant to the general superintendent of production in Findlay, Ohio, in 1952.

Carl B. Norberg has been promoted to junior petroleum engineer by Sun Oil Co. at Victoria, Tex. Norberg has been serving as a petroleum engineer trainee at Delhi, La.

J. H. Ware, Jr., senior landman with Union Oil Co. of California, has been transferred from Bismarck, N. D., to Denver.

Melvin G. Oxsen has joined the staff of Lion Oil Co.'s production and exploration district office in Denver as a geologist trainee.

George W. Crumrine has been transferred to Pampa, Tex., as district super-

PERSONALS

intendent by Sinclair Oil & Gas Co. Before his transfer, Crumrine had been district superintendent at Bairoil, Wyo.

Elbert F. Davis has been promoted to petroleum engineer by Continental Oil Co. at Linch, Wyo. Davis had been serving with Conoco as an engineering trainee.

Wilbur H. Seifert, former state oil and gas inspector for the commonwealth of Virginia, has resigned to join **Raymond A. Ransom** of Washington, D. C., as a consulting engineer.

V. L. VERDIANI

Vincent L. Verdiani has been named acting manager of the foreign department of Sun Oil Co. Verdiani has been with Sun since 1947, when he was hired as industrial products representative at Syracuse. He transferred to the general offices in Philadelphia as a technical representative in 1952. Verdiani succeeds **William C. Taylor,** who has retired because of ill health. Taylor joined the company in 1933 and was named head of the foreign department in 1947.

Morris H. (Benny) Benson, district geologist in the Tulsa office of Warren Petroleum Corp., has been promoted to district geologist for the West Texas area with offices at Midland, Tex. **Kenneth Keene,** who has been on the geological staff at Midland, has been promoted to district geologist for the New Mexico area. **R. A. Hobbs,** who has been stationed in Abilene, Tex., has been promoted to district geologist for Oklahoma with offices at Tulsa.

Fred P. Lobban has been named resident manager of the Athens, Greece, branch of George Armistead & Co. of Washington, D. C. Lobban will direct the firm's work in connection with a 30,000-bbl. refinery planned for Greece.

J. C. Johnston, head of production for Continental Oil Co. in the Rocky Mountain area, has been selected to receive the American Petroleum Institute certificate of appreciation at the annual meeting of the A.P.I. in November. Others selected for the award are: **C. V. Millikan,** Amerada Petroleum Corp.; **P. A. Mills,** Moody Engineering Co.; **D. V. Carter,** Magnolia Petroleum Co.; and **C. E. Reistle, Jr.,** Humble Oil & Refining Co.

Howard V. Smith has been named vice president in charge of refining by the board of directors of Kendall Refining Co. Smith had been serving as manager of refining and a member of the board of directors. **G. Harold Osborne,** general manager of sales for Kendall, has been named vice president in charge of marketing for the company.

H. V. SMITH

G. H. OSBORNE

Transportation Club Officers Prepare for Meeting

The 1954-55 officers and directors of the Transportation Club of the Petroleum Industry are preparing for the organization's eighth annual meeting scheduled in the Bismarck Hotel, Chicago, November 8, during the American Petroleum Institute annual convention. The officers are, standing, left to right: H. H. Theisen, Shippers Car Line Corp., Tulsa; J. P. Dennis, The Texas Co., New York City; T. G. Kees, Chicago Great Western Railway, Chicago; W. O. Narry, Richfield Oil Corp., Los Angeles; E. J. Schiffer, Gulf Oil Corp., Pittsburgh; P. G. Anderson, Lion Oil Co., El Dorado, Ark.; C. H. Wager, Shell Oil Co., New York City; H. L. Moul, Coastal Tank Lines, York, Pa.; Robert Maguire, Atlantic Refining Co., Philadelphia; A. G. Anderson, Socony-Vacuum Oil Co., New York City. Seated are: C. L. Davidson, Cities Service Oil Co., Chicago; S. E. Gebhardt, Union Tank Lines, Chicago; P. J. Bond, Pure Oil Co., Chicago; C. F. Dowd, Tide Water Associated Oil Co., New York City; L. R. Cowles, president of the club, Standard Oil Co. (Ind.), Chicago; P. H. Kuhns, Continental Oil Co., Ponca City, Okla.; R. R. Hooper, Cities Service Oil Co., New York City; and H. L. McReynolds, Kansas City, Mo., who was with Socony-Vacuum before his retirement. Officers not present for the picture are: Gerald L. Phelps, National Petroleum Association, Washington, D. C.; J. M. Morris, Mississippi Valley Barge Line, Pittsburgh; and Paul H. Draver of the Chicago, Milwaukee, St. Paul & Pacific Railroad Co., Chicago.

Val R. Reese, former district geologist with Phillips Petroleum Co. in the Four Corners area of the San Juan basin, has resigned to join Pacific Northwest Pipe Line Corp. as chief geologist.

Robert C. McCain has joined Lion Oil Co. in the Casper, Wyo., district office as a geologist. Before taking the position with Lion, he had served as a geologist with **K. D. Owen** in the Rocky Mountain region.

James P. Patterson, vice president of American Oil Co., recently organized Standard Oil Co. (Ind.) subsidiary, has retired, ending a 37-day career with the company. Patterson, however, had a 37-year career with Pan American Petroleum & Transport Co., which was then Amoco's corporate parent. He was succeeded by **Verne N. Drew,** who will be general manager of the marine department.

R. H. Armour has been named production superintendent for Gibraltar Oil Co. with offices at Oklahoma City.

John S. Crews has joined Arabian American Oil Co. in New York City as a research geologist. Before going with Arabian, Crews had served with

PERSONALS

both Pure Oil Co. and Amerada Petroleum Corp.

J. C. Hinds has been elected president of Four States-Western Oil Refining Co. at Farmington, N. M. The company recently announced plans for a 2,000-bbl. refinery at Farmington.

J. Howard Marshall, vice president of Signal Oil & Gas Co. of Fort Worth, and **Gerald P. Peters,** president of Peters, Writer & Christensen of Denver, have been elected to the board of directors of Frontier Refining Co.

C. B. Schwartz has been named district manager of Rock Island Refining Co.'s exploration offices. The company recently announced that it was transferring the offices from Oklahoma City to Denver.

George T. Becker has joined the geological staff of Gulf Oil Corp. at Oklahoma City.

D. L. Edmiston has been named president of Arrow Drilling Co. succeeding I. H. Patton, Jr., who died in May. Edmiston joined Arrow in 1932 and served with the firm in Tyler, Tex., Dallas, and Oklahoma City. Before his promotion, he had been serving as vice president in charge of production and drilling.

Daniel J. Pickrell has resigned his partnership in Golden Gate Petroleum Co. to open offices as a consulting geologist in San Francisco. Pickrell, who is president of the Northern California Geological Society, worked as a geologist with Honolulu Oil Co. before the war.

J. Mark Gardner, Dallas, vice president of drilling for Delta Gulf Drilling Co., has been elected new chairman of the Dallas-Fort Worth chapter of the American Association of Oilwell Drilling Contractors. Other new officers are: Mark Hart, Rowan Drilling Co., Fort Worth, vice chairman; and H. D. Paxson, Dallas, membership director for the A.A.O.D.C., secretary-treasurer.

Dick McCrone, Parkersburg Rig & Reel Co., Gainesville, Tex., has been elected chairman of the newly formed Texoma chapter of the American Association of Oilwell Drilling Contractors. Other officers are: Don Trott, district engineer for Standard Oil Co. of Texas, vice chairman; E. R. Baker, Sinclair Oil & Gas Co., secretary-treasurer; Dave Tupman, Gary Nees Lumber Co., chairman of arrangements; and Dick Morris, Black, Sivalls & Bryson, Inc., chairman of membership committee. All are of Gainesville.

W. Jacque Yost has been named research director by Ohio Oil Co. Yost was formerly technical adviser to the director of research in Magnolia Petroleum Co.'s field research department in Dallas. Yost's department will give major attention at first to exploration and production.

George H. Rabson has been named chief reservoir engineer of the gas supply department of Transcontinental Gas Pipe Line Corp. Before joining Transco, Rabson served with Pan American Production Co. as technical assistant to the chief production engineer.

E. L. Dillon has been named by Shell Oil Co. as geologist in charge of its newly opened exploration and land district at Abilene, Tex. Dillon has been with Shell since 1949 and has served as geologist in the Midland, Tex., office since 1950. During 1953 he served for an extended period as administrative assistant to the vice president.

Merton E. (Doc) Austin, division petroleum engineer at Mount Pleasant, Mich. for Sun Oil Co., has been promoted to division superintendent of the operating department of the company's Michigan production division. **George E. Haas,** assistant division petroleum engineer, will replace Austin as division petroleum engineer. Austin has been with Sun since June 1940 after graduating from Texas A. & M. College with a B.S. degree in petroleum engineering. He has been with the Michigan production division for the past 7 years.

P. E. Davis, assistant division superintendent of Texas Pipe Line Co., and superintendent of Texas-Empire Pipe Line Co., and Kaw Pipe Line Co. at Tulsa, has retired after 38 years with the companies.

DEATHS

Wayne R. Harshbarger, 69, died recently at his home in Coalinga, Calif., from leukemia. He had served as superintendent for The Texas Co. in Coalinga for 20 years. He started his career in the Coalinga field over 50 years ago.

Ed E. Hurley, Shreveport independent, died at his home there recently.

Harry M. Hoberg, 51, administrative assistant in the production research department of Standard Oil Development Co., died recently in a White Plains, N. Y., hospital.

William Giffert, 45, Tulsa independent, died recently in Tulsa after a long illness. Giffert was with Stanolind Oil & Gas Co. in Tulsa and Casper, Wyo., 7 years before he resigned to become an independent in 1952.

Joseph Moore, 46, administrative assistant with Socony-Vacuum Oil Co., died recently at his home in Tenafly, N. J., after a long illness.

Charles F. Foster, 52, president of Foster Drilling Co., died recently in Cushing, Okla., after a heart attack. Foster began his drilling career in 1947 and brought in the first well in the Happy Valley field near Cushing.

John C. Day, 68, executive secretary and treasurer of Western Petroleum Refiners Association, died of virus pneumonia October 5 in a Tulsa hospital. Day had been associated with the oil industry since World War 1 and had worked with Wilcox Oil & Gas Co., Waite Phillips Co., and Barnsdall Refining Corp. before joining W.P.R.A. in 1936 at Tulsa.

Ellwood J. Munger, 71, founder of America's first oil field scouting service, died October 4 after a long illness. Munger got the idea for an oil information service in 1918 while he was employed by Union Oil Co.

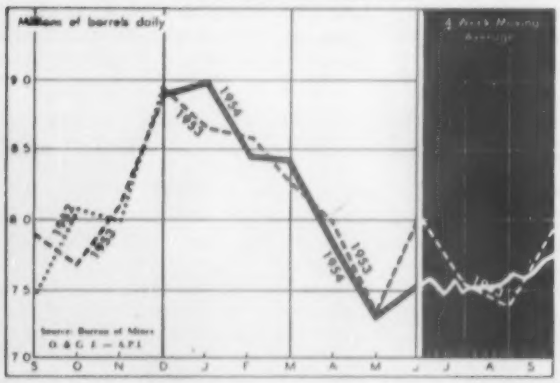
George W. Armstrong, Sr., 88, oil and steel industrialist, died in Natchez, Miss., October 1. Armstrong gained brief national fame in 1949 when he offered Jefferson Military College of Washington, Miss., land worth $50,000,000 if the school would teach racial superiority of the Anglo-Saxon and Latin American races.

Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,153,500	DOWN	18,950	DOWN	307,909
Crude stocks	272,574,000	DOWN	121,000	DOWN	12,091,000
Completions	880	DOWN	174	DOWN	89
Refinery runs	6,979,000	DOWN	20,000	UP	86
Gasoline stocks	152,118,000	UP	973,000	UP	11,289,000
Four-product stocks	375,112,000	UP	2,949,000	UP	18,911,000
Total imports	839,200	DOWN	357,200	DOWN	422,400

TOTAL DEMAND – ALL OILS



Well Completions Decline But Total For Year Will Be All-Time Record

OIL operators' answers to the Journal's drilling survey at midyear indicated that well completions for the last half would fall below the record set during the first 6 months. Despite the decline in wells scheduled for the last half, total completions for the year will not only set a new record but will beat the old record by about 4.6 per cent.

Total completions for the week ended October 7 dropped to 880 wells for the lowest week this year, but this was to be expected from operators' reports at midyear. Total completions for the year through October 2 amounted to about 40,400 wells. In order to reach the total of 51,540 wells forecast at midyear, completions will have to average about 860 wells per week between now and the end of the year.

Abnormal periods . . . A comparison of scheduled completions in the last 6 months of this year with either the last half of 1953 or the first 6 months of 1954 does not give a true picture of drilling trends.

Completions in the last half of 1952 lagged because of the material shortages following the steel strike. This shortage continued into the first half of 1953. Actually, the total for the first half of 1953 was slightly less than the first half of 1952.

As material became available, operators stepped up the drilling pace and completed 15 per cent more wells in the last half of 1953 than in the same period of 1952. This high drilling rate extended into the first half of 1954. These record periods, the last half of 1953 with 26,116 wells and the first half of 1954 with 25,904, should not be used as bench marks for measuring current drilling activity. Well completions for the last 6 months of this year will exceed all other half-year records except for the periods mentioned above.

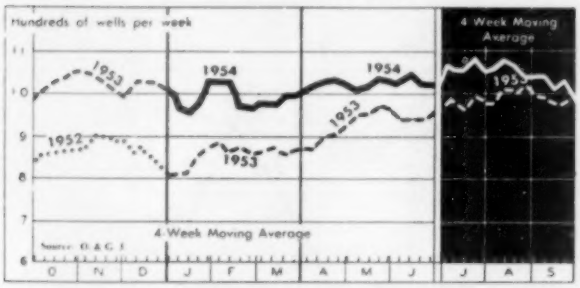
There was no drop in completions this year in the third quarter. The average for the 12-week period ended September 25 was actually greater than the average for the first half, but the big decrease for the week ended October 2 may be an indication of the trend for the fourth quarter.

Area trends . . . For the period through October 2, the greatest percentage increase in total completions was reported for Colorado. Completions were up 87 per cent to 986 wells, and wildcats accounted for 45 per cent of the total.

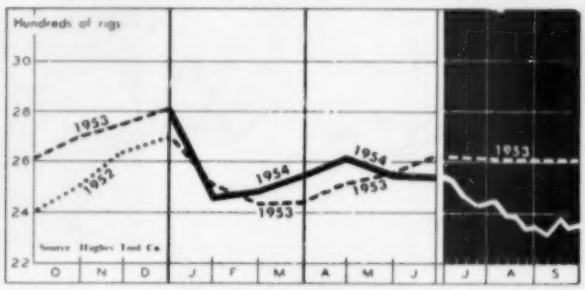
Wyoming completions gained 70 per cent, but Montana dropped 25 per cent. Similar results were reported for Illinois and Indiana. Illinois wells increased 46 per cent in contrast with the decrease of 39 per cent for Indiana. Oklahoma completions are up 21 per cent, but the Kansas total is down 7 per cent.

Development drilling in North Louisiana was the major factor in the 71 per cent increase for that area.

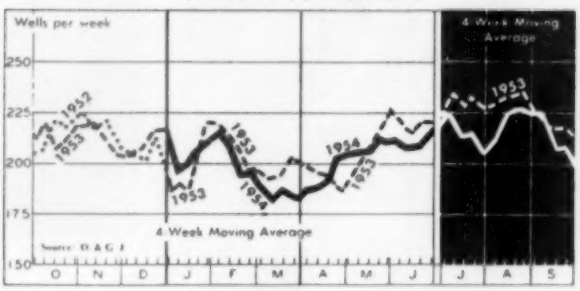
TOTAL COMPLETIONS



ROTARY RIGS OPERATING IN UNITED STATES



WILDCAT COMPLETIONS



ACTIVE ROTARY RIGS

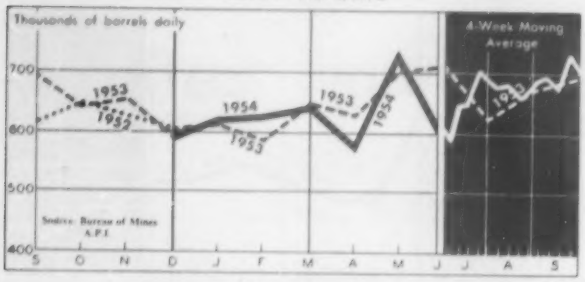
Area—	10-4-54	Change from 9-27-54	Change from 10-5-53
Gulf Coast	494	3	— 72
N. and W. Texas-New Mexico	738	9	— 78
Arkansas-N. Louisiana-E. Texas	172	—13	— 10
Oklahoma	268	— 8	— 89
Kansas-S. Nebraska	154	— 9	— 11
Illinois-Eastern	148	23	— 5
Rocky Mountain	258	8	— 18
Pacific Coast	132	4	— 32
Total United States	2,364	17	—315
Western Canada	135	15	— 41

WEEKLY WELL COMPLETIONS . . . WEEK ENDED OCTOBER 2, 1954

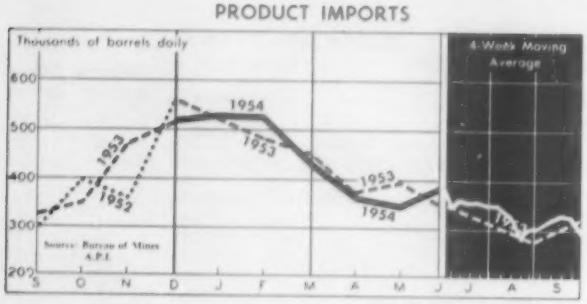
	Total of all wells					Cum.		Wildcat completions and discoveries					Cumulative total, 1954				
	Comp.	Oil	Gas	Dry	Footage	1954	1953	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
Ala.-Ga.-Fla.	2	0	0	2	10,141	84	111	0	0	0	2	2	2	0	2	73	77
Arkansas	20	13	1	6	65,480	495	411	0	0	0	3	3	20	0	4	95	119
California	49	35	0	14	213,953	1,788	1,943	1	0	0	10	11	47	1	10	390	448
Colorado	22	5	1	16	107,215	986	527	1	0	0	9	10	28	0	14	398	440
Illinois	70	50	0	20	157,722	2,145	1,465	0	0	0	0	0	8	0	0	233	241
Indiana	10	4	0	6	18,460	597	980	0	0	0	0	0	7	0	0	107	114
Kansas	75	39	1	35	259,689	3,441	3,700	0	0	1	9	10	61	0	18	458	537
Kentucky	17	8	3	6	27,232	849	842	0	0	0	2	2	14	0	3	89	106
Louisiana	39	30	2	7	214,512	2,652	2,003	1	1	0	5	7	85	44	29	262	420
North	26	20	2	4	88,000	1,459	853	1	0	0	2	3	13	3	11	110	137
South	13	10	0	3	126,512	1,193	1,150	0	1	0	3	4	72	41	18	152	283
Michigan	6	2	0	4	17,348	420	448	0	0	0	2	2	13	0	0	156	169
Mississippi	9	2	0	7	66,003	310	277	0	0	0	5	5	9	1	0	112	122
Montana	5	2	0	3	21,753	244	327	0	0	0	3	3	4	0	2	81	87
Nebraska	10	4	0	6	53,079	323	255	1	0	0	4	5	19	0	3	98	120
New Mexico	11	9	1	1	58,306	812	1,075	0	0	0	1	1	13	0	15	83	111
North Dakota	7	3	0	4	55,982	223	197	0	0	0	3	3	4	0	0	83	87
Ohio	24	9	6	*9	58,320	871	808	0	0	0	0	0	3	0	5	13	21
Oklahoma	137	88	4	†45	472,512	6,878	5,667	2	0	1	12	15	92	3	20	506	621
Pennsylvania-New York	35	12	9	‡14	63,189	1,761	1,987	0	0	0	0	0	0	0	6	30	36
Texas	296	162	12	122	1,314,920	13,947	12,942	12	0	2	64	78	608	59	137	3,173	3,977
Southwest (1 & 4)	40	20	0	20	197,896	1,999	2,074	5	0	0	14	19	88	24	38	548	698
Gulf Coast (2 & 3)	41	20	5	16	249,188	2,014	1,895	1	0	0	9	10	64	29	41	508	642
East (5 & 6)	12	5	0	7	59,123	725	598	0	0	0	5	5	12	0	13	221	246
North Central (7-B & 9)	113	44	3	66	332,785	5,206	4,914	5	0	2	26	33	275	4	18	1,269	1,566
West (7-C & 8)	74	63	0	11	415,598	3,247	2,858	1	0	0	8	9	166	0	19	558	743
Panhandle (10)	16	10	4	2	60,330	756	603	0	0	0	2	2	3	2	8	69	82
Utah	2	0	0	2	2,281	57	50	0	0	0	2	2	3	0	1	32	36
West Virginia	15	0	12	3	45,083	454	467	0	0	1	1	2	0	0	24	14	38
Wyoming	16	11	0	5	70,516	962	566	1	0	0	3	4	30	0	6	145	181
Miscellaneous (Nevada)	3	0	0	3	22,291	97	65	0	0	0	3	3	3	0	0	28	31
Total United States	880	488	52	340	3,395,987	40,396	37,113	19	1	5	143	168	1,073	108	299	6,659	8,139
Total previous week	1,054	572	74	408	4,351,910			30	6	11	174	221	1,054	107	294	6,516	7,971
Total Oct. 3, 1953	969	521	66	382	3,727,269			21	1	6	142	170	1,112	81	282	6,896	8,371

Service wells included: *3, †6, ‡7.

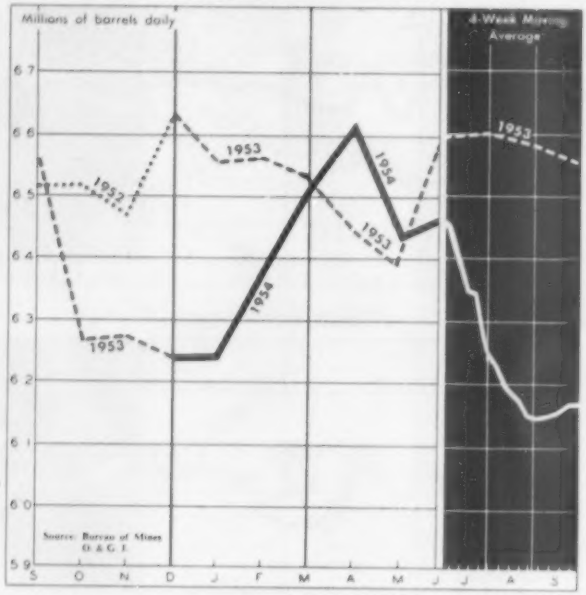
CRUDE IMPORTS



PRODUCT IMPORTS



CRUDE-OIL PRODUCTION

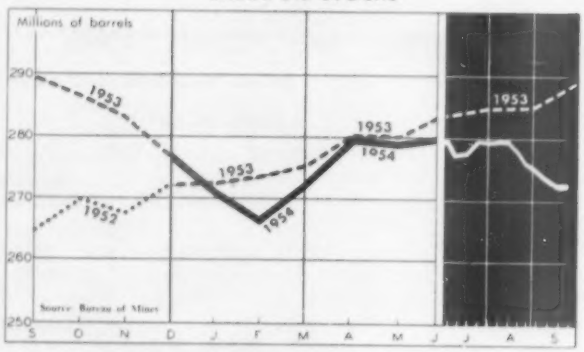


DAILY AVERAGE PRODUCTION FOR WEEK

	October 2			Sept. 25
	Crude oil	Lease condensate	Total	total
Alabama	4,100		4,100	4,200
Arkansas	76,700	500	77,200	76,750
California	958,300		958,300	959,100
Colorado	132,300		132,300	127,900
Eastern	53,800		53,800	54,000
Florida	1,525		1,525	1,500
Illinois	181,300		181,300	181,900
Indiana	27,900		27,900	27,800
Kansas	316,700		316,700	317,200
Kentucky	37,600		37,600	37,700
Louisiana	580,475	41,700	622,175	620,050
North	104,200	2,700	106,900	106,400
South	476,275	39,000	515,275	513,650
Michigan	33,000		33,000	30,800
Mississippi	88,000	3,000	91,000	90,500
Montana	39,700		39,700	39,100
Nebraska	19,300		19,300	19,000
New Mexico	205,100	2,250	207,350	207,050
Oklahoma	465,600		465,600	496,700
Texas	2,562,175	47,575	2,609,750	2,609,700
Dist. 1	41,975	400	42,375	42,300
Dist. 2	128,825	7,550	136,375	134,750
Dist. 3	403,250	22,300	425,550	426,200
Dist. 4	225,650	5,300	230,950	230,800
Dist. 5	43,350	425	43,775	43,850
Dist. 6	108,725	4,600	113,325	113,600
East Texas field	208,700		208,700	209,500
Dist. 7-B	134,000	25	134,025	134,025
Dist. 7-C	171,850	4,600	176,450	176,500
Dist. 8	829,425	2,000	831,425	832,900
Dist. 9	182,000	350	182,350	181,250
Dist. 10	84,425	25	84,450	84,025
Utah	4,400		4,400	4,900
Wyoming	255,800		255,800	252,200
North Dakota	‡14,700		‡14,700	‡14,400
Total U. S.	6,058,475	95,025	**6,153,500**	6,172,450
Change from previous week, down			**18,950**	
Canada	†290,000		†290,000	†312,900
Total U. S. production January 1-October 2			1,746,119,050 bbl.	
Same period last year (crude plus cond.)			*1,797,086,777 bbl.	

*Includes 24,941,450 bbl. condensate. †Week ended previous Monday. ‡Includes S. D. 200 bbl.

CRUDE-OIL STOCKS



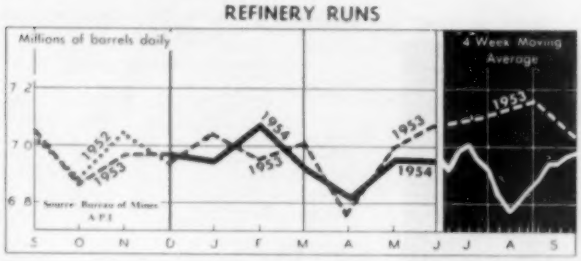
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

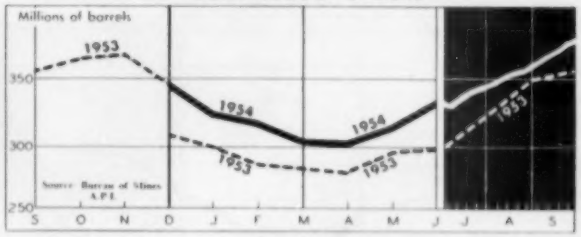
	Sept. 25, '54	Sept. 18, '54	Sept. 26, '53
Pennsylvania Grade	3,097	3,116	2,771
Other Appalachian	1,501	1,572	2,119
Illinois, Indiana, Michigan	13,007	12,800	12,222
Kansas	9,928	9,862	10,431
Oklahoma	24,880	24,517	31,422
Arkansas	3,371	3,308	3,029
Louisiana	15,840	16,003	16,849
North	2,459	2,555	2,659
Gulf	13,381	13,448	14,190
Mississippi	3,293	3,106	3,712
New Mexico	8,748	8,956	9,875
Texas	127,758	128,223	133,196
East Texas proper	11,257	11,125	11,839
West Texas	56,983	57,058	59,040
Texas Gulf	25,072	25,333	28,568
Other Texas	34,446	34,707	33,749
Wyoming	12,486	12,618	13,692
Other Rocky Mountain	5,005	5,336	2,920
California	32,089	32,701	32,699
Foreign	†11,571	10,577	9,728
Total	272,574	272,695	284,665

*Bureau of Mines. †Includes 2,647,000 bbl. in California.

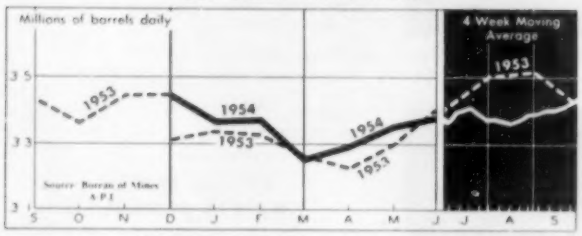
REFINERY RUNS



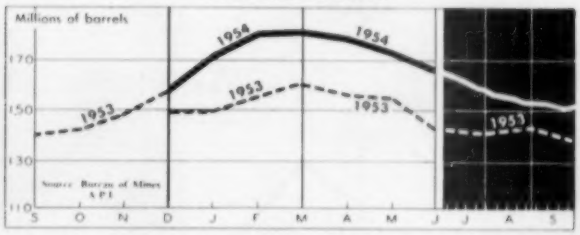
FOUR-PRODUCT STOCKS



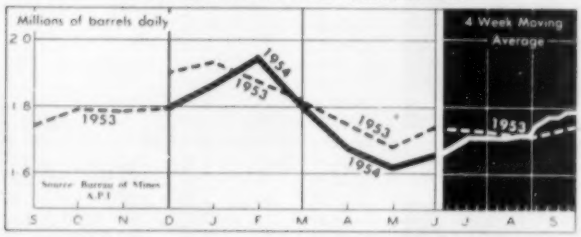
GASOLINE PRODUCTION



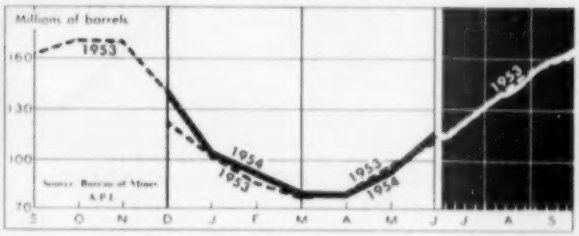
GASOLINE STOCKS



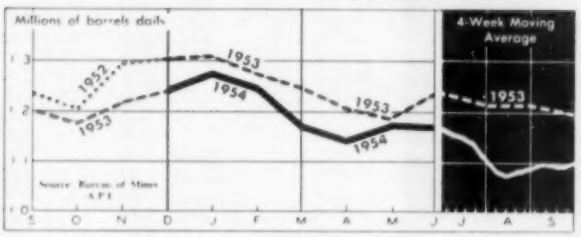
MIDDLE-DISTILLATE PRODUCTION



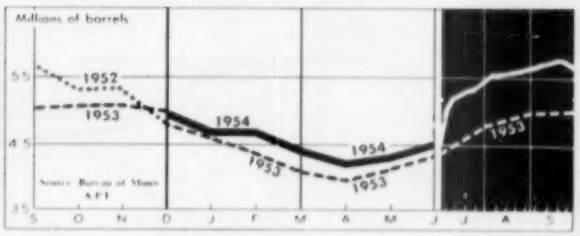
MIDDLE-DISTILLATE STOCKS



RESIDUAL PRODUCTION



RESIDUAL STOCKS



A.P.I. REFINERY REPORT, OCTOBER 1

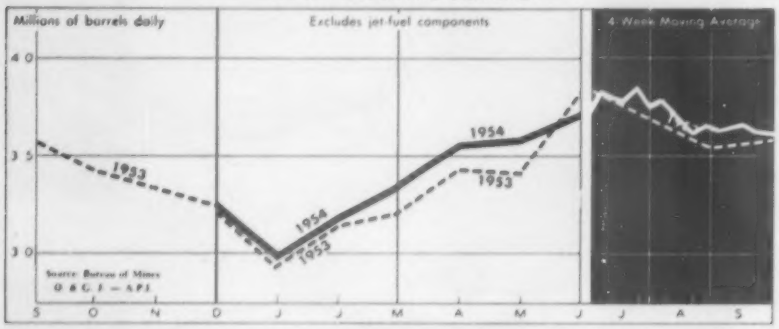
(Excludes all jet-fuel components)

(Thousands of barrels)

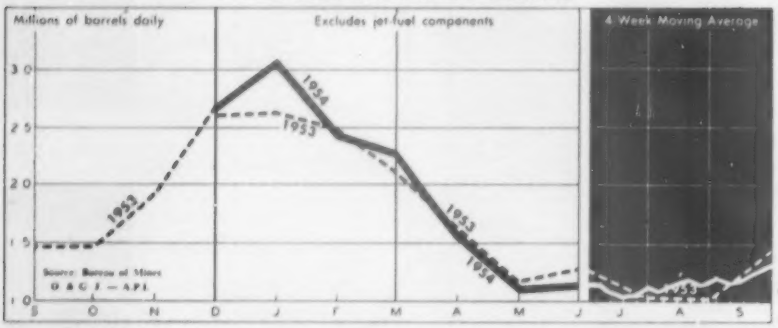
District—	Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.	Stocks‡—Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, October 1953—Daily avg. runs	Daily average production—Gaso.*	Kero.	Dist.	Resid.
East Coast	1,095	472.5	25.1	302.7	199.0	35,166	15,138	45,890	10,622	1,009	428.7	33.8	256.1	209.9
Appalachian:														
District 1	100	47.7	5.0	21.7	9.1	4,390	702	2,435	476	109	46.2	6.2	17.1	11.2
District 2	76	39.0	4.4	11.0	7.9	2,356	447	764	332	85	46.2	4.3	13.0	12.5
Ind., Ill., Ky.	1,245	691.2	80.1	237.3	138.0	33,578	9,902	25,815	4,298	1,269	703.2	86.9	224.2	169.4
Okla., Kans., Mo.	561	313.9	12.7	131.0	38.1	13,879	2,429	12,909	1,225	565	330.7	10.6	138.9	49.0
Inland Texas	234	178.4	8.9	46.0	21.0	5,473	352	2,319	1,284	250	180.8	11.7	44.2	29.7
Texas Gulf Coast	1,703	832.0	116.9	393.7	227.7	19,774	4,713	15,349	6,828	1,639	822.9	131.6	383.8	235.0
La. Gulf Coast	583	312.4	35.3	157.2	46.6	9,027	3,013	5,206	1,463	548	273.8	53.5	150.2	43.7
N. La. and Ark.	85	32.7	6.9	20.7	4.6	4,374	1,076	1,361	124	90	38.2	7.2	20.1	7.2
Rocky Mountain:														
New Mexico	19	11.3		3.3	2.7	263		87	37	20	12.6	.4	3.0	3.9
Other Rocky Mtn.	235	104.6	3.7	53.9	38.3	5,621	266	2,763	884	225	110.4	2.0	52.4	40.7
California	1,043	445.9	10.6	111.4	396.7	18,217	352	13,341	28,792	1,063	443.3	6.9	159.3	372.2
Oct. 1, 1954	6,979	3,481.6	309.6	1,489.9	1,129.7	152,118	38,390	128,239	56,365	6,872	3,437.0	355.1	1,462.3	1,184.4
Sept. 24, 1954	6,999	3,425.0	325.7	1,494.4	1,067.0	151,145	38,212	125,571	57,235					
Oct. 3, 1953	6,893	3,348.4	347.6	1,463.1	1,178.4	140,829	36,756	126,704	51,912					

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

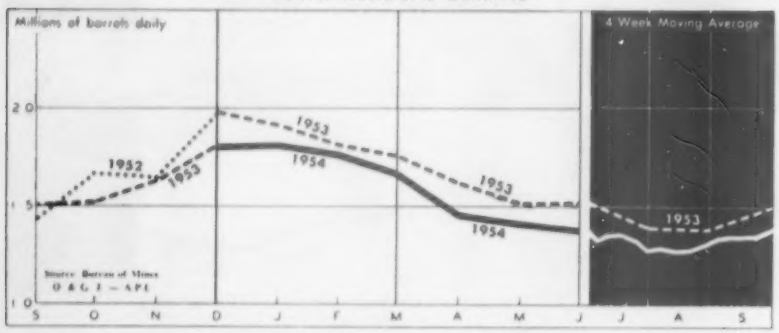
TOTAL GASOLINE DEMAND


Millions of barrels daily
Excludes jet-fuel components
4 Week Moving Average
1954
1953
1952
Source: Bureau of Mines
O & G J — API
S O N D J F M A M J J A S

TOTAL MIDDLE-DISTILLATE DEMAND


Millions of barrels daily
Excludes jet-fuel components
4 Week Moving Average
1954
1953
1952
Source: Bureau of Mines
O & G J — API
S O N D J F M A M J J A S

TOTAL RESIDUAL DEMAND



REPRESENTATIVE QUOTATIONS

Spot-market quotations of leading suppliers as of October 6, 1954. Prices are in cents per gallon, except for residual in dollars per barrel and wax in cents per pound.

GASOLINE, KEROSINE, AND FUEL OILS

	Mid-Continent Group 3	New York Harbor (barge)	Texas Gulf Coast
Regular gasoline	10.25-11	11.25-12	10.50-10.75
Premium gasoline	11.25-12	13-13.75	11.50-11.75
42-44 w.w. kerosine	9-9.25	10.10	9-9.25
No. 2 straw fuel oil	8.25-8.5	9.35	8.5
No. 6 residual	$1.25-1.30	$2.25-2.35	$1.85-1.95

NATURAL GASOLINE

	Group 3	North Texas	N. La.
Grade 26-70	5.0	4.5	4.75
Grade 18-55	6.0	5.5	5.75

LUBRICATING OILS

Mid-Continent

150-160 vis., D bright stock, 0-10 pp.	18
200 vis., No. 3 neutral, 0-10 pp.	13.25

WAX

Mid-Continent

132-134 A.M.P.	6.0

• Kerosine and distillate fuel markets on the Gulf Coast and East Coast have stabilized at the new prices. Discounts off Group 3 posting for No. 2 fuel have been reduced, resulting in a net increase of 0.125 cent a gallon in spot prices.

PRODUCTION AND DEMAND—MAJOR PRODUCTS

(Thousands of barrels daily)

	Refinery prod.	Total demand
Gasoline:		
Four weeks ended 10-1-54	3,434	3,604
July 1954	3,385	3,723
September 1953	3,432	3,579
October 1953	3,359	3,423
Middle distillate:		
Four weeks ended 10-1-54	1,800	1,327
July 1954	1,711	1,106
September 1953	1,745	1,453
October 1953	1,795	1,479
Residual fuel:		
Four weeks ended 10-1-54	1,130	1,379
July 1954	1,089	1,243
September 1953	1,203	1,498
October 1953	1,184	1,521

CRUDE PRICES GRAVITY SCHEDULE

	Signal Hill, Calif.*	Okla-homa, Kansas	Gulf Coast Tex.†	West Tex.‡
14-14.9	$1.87	....	....	....
15-15.9	1.93	....	....	....
16-16.9	1.99	....	....	....
17-17.9	2.05	....	....	....
18-18.9	2.11	....	....	....
19-19.9	2.18	....	....	....
20-20.9	2.24	$2.50	....	$2.37
21-21.9	2.30	2.52	....	2.39
22-22.9	2.37	2.54	....	2.41
23-23.9	2.45	2.56	....	2.43
24-24.9	2.53	2.58	$2.91	2.45
25-25.9	2.61	2.60	2.93	2.47
26-26.9	2.69	2.62	2.95	2.49
27-27.9	2.76	2.64	2.97	2.51
28-28.9	2.83	2.66	2.99	2.53
29-29.9	2.91	2.68	3.01	2.55
30-30.9	2.97	2.70	3.03	2.57
31-31.9	3.04	2.72	3.05	2.59
32-32.9	3.12	2.74	3.07	2.61
33-33.9	....	2.76	3.09	2.63
34-34.9	....	2.78	3.11	2.65
35-35.9	....	2.80	3.13	2.67
36-36.9	....	2.82	3.15	2.69
37-37.9	....	2.84	3.17	2.71
38-38.9	....	2.86	3.19	2.73
39-39.9	....	2.88	3.21	2.75
40 and above	....	2.90	3.23	2.77

*Standard Oil Co. of California. †Upper Texas Gulf Coast. ‡Includes New Mexico Permian.

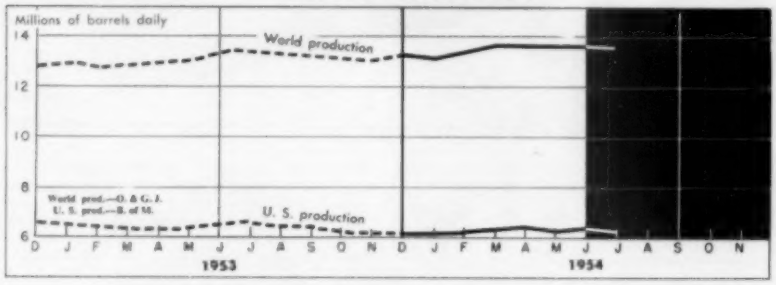
Effective dates: California, February 16, 1953; east of California, June 15, 1953; Pennsylvania Grade, September 1, 1954.

FLAT CRUDE PRICES

Representative posted schedules per barrel.

Louisiana:	
Cotton Valley (distillate)	$3.00
Cotton Valley (Holloway crude)	2.95
Texas:	
East Texas	2.90
Chapel Hill	2.83
Conroe	3.13
Van	2.73
Pennsylvania Grade:	
Bradford	3.00-3.23
Middle District	3.15
Southwest Pennsylvania	2.81
West Virginia	2.70
Ohio	2.74
Illinois Basin	2.90-3.02

CRUDE-OIL PRODUCTION

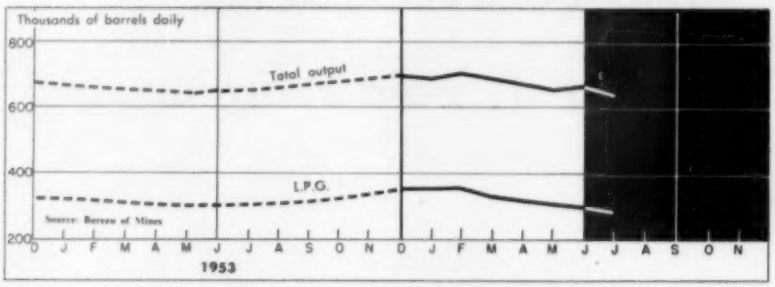


CRUDE PRODUCTION

(Thousands of barrels daily)

Month—	U.S.	World
July 1954	6,242	13,525
June 1954	6,500	13,674
May 1954	6,471	13,681
November 1953	6,277	13,000
July 1953	6,603	13,325

NATURAL-GASOLINE AND CYCLING-PLANT PRODUCTION

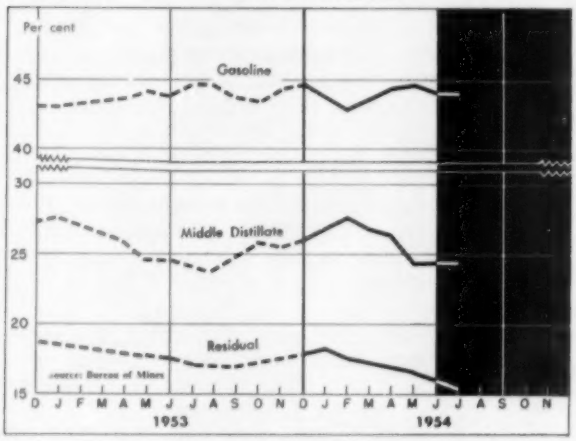


PRODUCTION AT NATURAL-GASOLINE AND CYCLING PLANTS

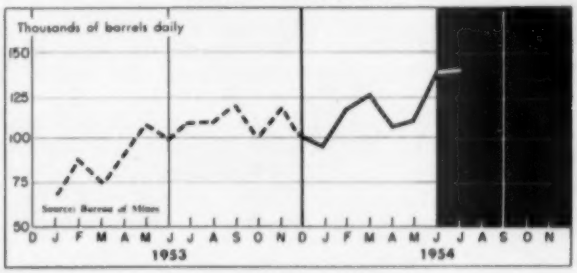
(Thousands of barrels daily)

Month—	L.P.G.	Total
July 1954	286	642
June 1954	299	660
May 1954	304	657
November 1953	330	683
July 1953	297	648

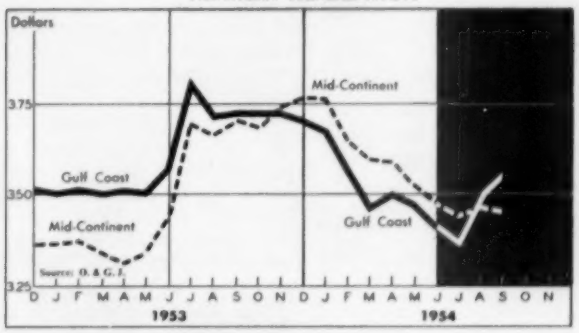
REFINERY YIELDS



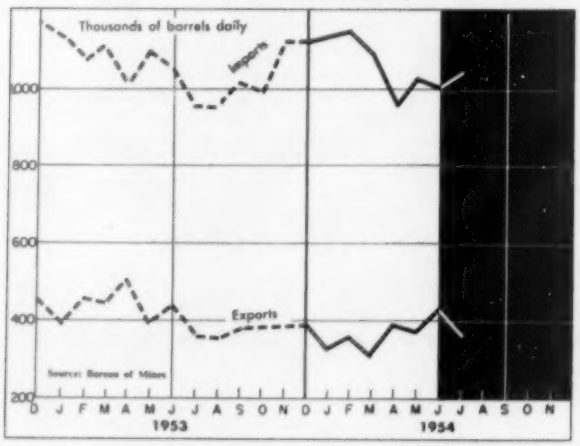
JET-FUEL PRODUCTION



REFINERY REALIZATION



IMPORTS-EXPORTS



REFINERY REALIZATION

	Sept.* 1954	Aug.* 1954	July 1954	Sept. 1953
Mid-Continent	$3.44	$3.46	$3.46	$3.70
Gulf Coast	3.54	3.52	3.39	3.73

*Preliminary.

Refinery realization is based on yields of major products and average spot prices of regular gasoline, kerosine, No. 2 fuel, and residual as published in The Oil and Gas Journal.

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Gaso Duplex 4½" x 6" Power Pumps with Chrysler C-36 Engines, skid mounted, immediate delivery. Also Byron Jackson, Carter Centrifugal Units. Westinghouse 20-25-50 KW Generating Units.

H. H. COFFIELD
Attn.: W. H. ORR
Phones: 132—Rockdale, Texas
AT-3427—Houston, Texas

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NEW
DRILL PIPE

185 joints (Approximately 5,550') of new 3½" OD 13.30# Grade D Spang External Upset, Internal Flush drill pipe. Equipped with 5" OD Spang Double Seal Shrink Thread Internal Flush Tool Joints. Range 2. Location—Oklahoma City. Price —$388.84 per 100', plus sales tax.

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Phillips Petroleum Company
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Gasoline Plant, located in Brazoria County, Texas, shut down in January, 1954. Had been processing approximately thirty-three million feet of gas daily with absorber pressure approximately six hundred thirty pounds. Plant recovered Propane, Butane, Gasoline, Kerosene and Diesel Oil. Adequate storage tanks for all products. Drum Lead Blending Plant. Detailed inventory available upon request.

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WILSON ATLAS—$20,159; 2-LI-600 Cummins in good condition: enclosed oil-bath compound: includes one American and one plain cathead, one 1000 Gal. full tank. Call Madison 1923, Houston or Amherst 73311 Wichita or write P. O. Box 2001, Wichita, Kansas.

36,000' 6⅝" OD 18.97 Plain End Beveled New Southchester Lap Weld Line Pipe. For Quick Movement Offer Nice Discount. Pipe Located in El Dorado, Arkansas. Telephone, Wire or Write Louisiana Iron and Supply Company, Shreveport, Louisiana.

PAIR SURPLUS 1879 Buda engines completely overhauled since use, each equipped with Twin Disc 27-inch hydraulic couplings. Engines located Wolf Trucking yard, Edmond, Okla. Price for pair, $7,000.00. Chester H. Westfall, Phone 4-3144, Tulsa.

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Franks East Texas Unit, mounted on K-10 International Truck. Located in Seminole area.
Franks Model 65/44 DTRD Double Drum Trailer Mounted Workover and Drilling Rig. Serial 1327 96', 150,000# Telescoping Derrick. Located at Alice, Texas.
Franks 7000 Single Drum Skid Swabbing Unit mounted on Dodge Tandem Truck. Located Odessa, Texas.
Franks SAL 4500 Skid Rotary Rig Cummins Power, 96' Derrick. Located, Tulsa, Oklahoma.

O.C.S. Type 3 Servicing Unit mounted on 1942 Mack Truck. Located Odessa, Texas.
Franks Super Senior Well Servicing unit 8 x 10 x 62 Single Pole Mast mounted on Tandem International Truck, Located Seminole, Oklahoma.
Write, wire or call Franks Mfg. Corporation, Box 3218, Whittier Station, Tulsa, Oklahoma.

FOR SALE EQUIPMENT

FOR SALE: Sullivan 200 complete with all tools ready to work. Located Tulsa, Okla. Contact R. F. Mesker, Phone 6-0057 or 5-9357, Tulsa.

FOR SALE: ENGINE—165 Hp. Climax Model R61, maximum continuous Hp. rating 126 Herndon Drilling Company, 421 Mayo Building, Tulsa, Phone 4-9700.

WELL DRILLING EQUIPMENT. New and used spudders, rotaries, core drills. Tools, pipe, cable. Everything for well drilling. Fishing tools rented. Pressey & Son, Pueblo, Colo.

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8—Stainless steel columns: 8' x 61', 7' x 25', 6' x 64', 6' x 45' 850#, 4' x 110', 4' x 70', 2' x 73', 2' x 39'.
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BOX H-461, THE OIL AND GAS JOURNAL,
Tulsa, Oklahoma

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FOR SALE: Franks SAL 6000, recently overhauled, also new drilling line and brake blocks installed; Franks 96 foot mast; 3—200 HP Cummins Diesels in good shape with V-belt compound; 7¼" x 16" Gardner-Denver pump, 8' flywheel; 4' substructure; 6400' of 3½" IF drill pipe; 6 brand new drill collars and three old ones; one 8x5x29' steel mud tank; steel dog house; steel pipe racks; and jets, wrenches, etc. Rig can be seen 6 miles north and three miles west of Ordway, Colo. Contact DeVere Robinson, Salt Lake City, Utah. Phone 7-0049 or write 1940 S. 11th E.

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FOR SALE—Motorola two-way radio system for Petroleum industry complete with two base stations, 1 set for drilling rig complete with generator and antenna, two 6-volt mobile units and one 12-volt mobile unit. This equipment is in perfect condition just one year old. Will sell at discount. Contact Wycoff Drilling Company, Oakley, Kansas.

FOR SALE, used Tex-Steamers, one twenty horsepower gas fired, two forty horsepower oil fired. For details write Tex-steam Corporation, P. O. Box 9127, Houston 11, Texas.

3 VERY GOOD Used Goulds Centrifugal Pumps. 1500 GPM—150 ft. head. $200.00 each, F.O.B. Morgantown. Robert L. Gall, 30 W. Jefferson St., Morgantown, W. Va.

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GEOLOGIST—Senior Research, to work in New York. Applicant should have advanced degree and broad experience in petroleum geology, foreign and domestic. Work involves compilation of geological data, evaluation of foreign petroleum prospects and preparation of reports. Important petroleum organization offers this position of responsibility and appeal to the right party. Pay commensurate with education and experience. Age range, preferably 35 to 50. Submit resume in detail. Box H-417, The Oil and Gas Journal, Tulsa, Oklahoma.

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FOREIGN EMPLOYMENT. List of oil companies and drilling contractors showing where to apply for foreign jobs. OIML Co., Box 2603, Tulsa, Okla. $5.00 cash.

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Ages 30-40

Required by major oil company for career employment in South America.

Graduate mechanical or electrical engineers with 8-15 years experience in particular field and with potentiality for development into administrative or consulting position. Must have knowledge of both the design and execution phases of engineering. Must have been in charge of engineering projects of major proportions and with experience in working with engineering specialists solving problems which overlap several branches of the profession. Must have had experience in the conception, design or execution of major works of complex nature. May be either technical or administrative but must have experience in report writing and be capable of expression in presenting problems or justifying projects. Salary plus bonus $14,500 - $22,000. Also tax savings, liberal benefits and home vacations with travel allowances. Replies confidential.

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Dept. K-21

General Post Office

New York 1, New York

HELP WANTED

HELP WANTED

WANTED

An Able Refinery Manager for Middle East Country

Excellent Compensation
3 - 5 Year Contract with Liberal Provisions

We are seeking a man 40-55 years of age (perhaps older) with experience and fully capable of managing a 25,000 b.p.d. oil refinery located in Middle Eastern country. He must be able to assume full responsibility for the successful operation of this new refinery. Will have freedom to select American personnel needed for other top positions but over the years he will be expected to develop local people for as many key positions as possible. No oil company is involved as this operation is owned by the foreign government who will make a liberal contract with excellent compensation. Location and housing desirable. Because of tax advantages, this is attractive to an older, experienced man who would like to work for five or more years longer or for a younger, experienced man who would like a stimulating career. Please give complete details and personal history.

**BOX H-456, THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA**

YOUNG OIL TAX ACCOUNTANT, preferably with college and some experience, to work in New Mexico. Good opportunity for someone not afraid to work, who is congenial and will assume varied responsibilities. Reply should include details, references and starting salary expected. Box H-463, The Oil and Gas Journal, Tulsa, Oklahoma.

SUBSURFACE GEOLOGIST: Aggressive independent oil company has opening for top subsurface geologist that knows Oklahoma and Kansas and has general knowledge of the other Mid-Continent states. Under 40 years of age, and with major oil company experience preferred. In replying give past employment record, educational background, and full particulars. All replies handled strictly confidential. Box H-462, The Oil and Gas Journal, Tulsa, Oklahoma.

PHYSICAL CHEMIST or Physicist, Continental Oil Company, Ponca City, Oklahoma. Immediate opening for physical chemist or physicist. Advanced degree, Ph.D. preferred. Research work in Petrophysics group, Production Research Division. New laboratory building. Excellent benefits and working conditions. Address letter giving education, experience and salary requirement to Personnel Records Division, Continental Oil Company, Ponca City, Oklahoma.

PROCESS ENGINEERS

Chemical Engineers with advanced degrees required for process design and evaluation work. Minimum five years' experience in process design petroleum or organic chemical facilities required. Send complete resume. Box H-420, The Oil and Gas Journal, Tulsa, Oklahoma.

SEEKING TOP MANUFACTURERS AGENT

First opening this area to represent expanding million dollar pipe mill and fabrication plant. Send letter giving facts about your organization, area served, lines carried, yearly volume. Write Sales Manager,

Box H-434, The Oil and Gas Journal, Tulsa, Oklahoma.

SOUTH AMERICA
MAJOR OIL COMPANY

HAS OPENINGS IN COLOMBIA FOR

Petroleum Engineer (Equipment)—At least four years' experience as equipment engineer for testing, maintenance and operation of drilling and production equipment.

Drilling Engineer—Prefer Petroleum Engineer with six to eight years' minimum in drilling activities. Thorough knowledge modern drilling practices and techniques. Some administrative experience.

Petroleum Engineer—Minimum four years' experience in work-overs, well completion, maintenance and operation of drilling and production equipment.

AGE LIMIT 40 YEARS
SALARY OPEN

BOX H-432,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA

SITUATIONS WANTED

CONSTRUCTION SUPERINTENDENT: Twenty years experience in supervision, all phases processing plant and pipeline station construction with major engineer-constructors. Mechanical Engineering degree. Box H-453, The Oil and Gas Journal, Tulsa, Oklahoma.

ENGINEERING EXECUTIVE — Chemical engineer with 22 years broad experience in Petroleum refining covering Process design, development, licensing, economics, sales, construction and operation, seeks connection with aggressive, expanding corporation engaged in or serving Petroleum refining or Petrochemical fields. Box H-450, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER, 34, Married, 10 years—part time supervisory—diversified drilling, producing, remedial, reservoir, and associated experience in Gulf Coast. Desire position with organization offering opportunity for advancement. Will relocate. Box H-442, The Oil and Gas Journal, Tulsa, Oklahoma.

MR. PRESIDENT:

Why not concentrate on operations and let me assume responsibility for finance and accounting? Have experience in all phases of Oil industry including ten years as Controller, Treasurer, Financial Vice President and Director. Have B.C.S. Degree and am qualified to reorganize accounting personnel and procedures if necessary. Will invest in progressive Company. Box H-459, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST—Six years experience in South and East Texas, desires immediate connection with active company. 1628 North Boston, Tulsa, Okla.

MATERIAL MAN—15 years office and field experience. Drilling and Production. Best references. Box H-431, The Oil and Gas Journal, Tulsa, Oklahoma.

Well organized, well established oilwell drilling contractor desires the management and supervision of oil properties in West Texas, Central Texas, and New Mexico. Can provide complete handling of oil properties, from acquisition to production. No properties too small, and none too large to handle. Inquiries from independents, groups, small or medium sized oil companies invited.

Write, wire, or call collect for further information.

MAKIN DRILLING COMPANY

P. O. Box 1628, Hobbs, New Mexico,
Phone 3-3141.

146 Allen Building, Midland, Texas,
Phone 2-2962.

PRODUCTION WANTED

NEWLY ORGANIZED syndicate wants to buy 5,000 to 30,000 barrels oil monthly production. You will deal direct with principals. Prompt action. Evaluation report must accompany submittal. Box H-422, The Oil and Gas Journal, Tulsa, Oklahoma.

ROYALTIES

WANTED PRODUCTION or Producing Royalties, Oil or Gas. From Principal to Purchaser. Submit full particulars, payments, engineering reports, etc. Box H-455, The Oil and Gas Journal, Tulsa, Oklahoma.

WISH TO BUY producing royalties. Box H-379, The Oil and Gas Journal, Tulsa, Oklahoma.

JACK EAGLE, Oil Properties, 706 City Nat'l Bldg., Oklahoma City, Oklahoma. Telephone REgent 6-7027.

OFFERING CHOICE PRODUCING oil income royalties with large reserves per Dollar investments. A. S. Berry, 822 Wright Bldg. Tulsa, Okla.

LEASE AND DRILLING BLOCKS

PRODUCTION DEAL, New Pool, Well drilled, Schlumberger log, two oil sands, 1480-1820, 640 acre block. Need operator to finish well and drill block. Or $8000 tax money and will set pipe and in tanks. Box 106, Seminole, Oklahoma, Phone 1258.

RECENTLY ORGANIZED group seeking drilling deals accompanied by complete geological reports. Box H-423, The Oil and Gas Journal, Tulsa, Oklahoma.

Will pay cash instantly for lease (large blocks), royalties, mineral deeds, production. Write fully—P. O. Box 2153, Denver, Colorado.

SEE A. L. BOWLES, Box 947, Ada, Okla., for drilling deals and producing royalties if you have the cash for Oil Investments.

KANSAS WATER FLOOD oil lease for sale, has 1200 acres, five wells plus water wells, Gaso pressure pump, tanks and other equipment, owner Mr. O'Chamis, Tioga Hotel, Chanute, Kansas.

FOR SALE: A ¼ undivided working interest in a new well producing natural out of two sands, and the 60 acres on which it is located. Geological work indicates reserves conservatively in excess of 284,000 barrels under lease. Present well producing 16 barrels per day. Depth of sands 1350' and 1500'. Price subject prior sale $37,500, for ¼ interest. Principals that are able to finance their proportion of development costs need answer. Much larger wells are anticipated. Current plans are to drill 5 more wells. I am the owner of the ¼ interest being offered. Location, Western Kentucky. Box H-460, The Oil and Gas Journal, Tulsa, Oklahoma.

EASTERN KANSAS: 2965 acres in 5 drilling blocks, on known oil trends near Chanute, Kansas, one well on production, 4 bbl. per day on virgin 280 acre lease, everything new, all leases new for 5 years, owner is leaving Kansas, sell complete deal $16,500.00. Also have leasing blocks near production and proven production by one or more new wells. Production with protected acreage from 160 to 1600 acres. Core tests available on all blocks determining value as to water flooding, fracture treatment or experimental purposes. Priced from $5,000.00 to $250,000.00. For particulars write E. W. Rickey, Box 312, Chanute, Kansas.

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Producing and Nonproducing
Bought and Sold—Any Area

Inquiries Invited

B. D. BUCKLEY
6635 Delmar Ave., St. Louis, Mo.

WANTED

CAPITAL WANTED

Petroleum Geologist - Oil Producer wishes to contact qualified companies or small groups of individuals to spend tax money in the Denver-Julesburg Basin on drilling wells. This area is particularly attractive due to the high discovery ratio. We can furnish for your examination the best available geology. References exchanged.

BOX H-449,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

BUSINESS OPPORTUNITY

$69,000 HAS GROSSED over $500,000 in first 2 years. Producer of 60 low cost motion pictures desires asso. to finance popular adventure pictures in full color. Money repaid from entire first returns plus 45% share. Tax ad. Low risk. Box H-444, The Oil and Gas Journal, Tulsa, Oklahoma.

REAL ESTATE

FOR SALE: Kiowa Oil Company Yard, approximately three acres at Great Bend, Kansas, consisting of: 1 Quonset Building, 100' long, 40' wide, 20'3" high; 2 room office in one end of building, all cement floor, modern. 1 one story duplex building, 4 rooms on each side with bath. 1 Tool shed, 16x30. 1 Tool Building 26x30. 10 Welded Casing Racks made out of 4" drill pipe. 1 Truck Garage, 31x61. Yard is enclosed with 8' Wire Mesh Fence. Contact Kiowa Oil Company, 717 Union National Bank Bldg., Wichita 2, Kansas; phone FO 3-6013.

SPACE IS NEEDED: A Journal display classified advertisement is the quickest way to rent or sell your real estate. In the present period of expansion oil industry firms urgently need the space you have available. If it isn't listed here, you may also find it by stating your needs in these pages. For classified rates see box heading or write The Oil and Gas Journal.

OIL FORMS

KRAFTBILT FORMS, designed especially for the oil industry, are popular because they are efficient, economical. For all production-reporting forms, plat sheets, all administrative forms, columnar pads, truck reports, material transfer forms, ask for Catalog 854-K. Ross-Martin Co., P. O. Box 800-A, Tulsa, Okla.

BUSINESS OPPORTUNITY

Business Opportunity

We have 6500-foot rig in excellent condition, Ideco No. 700, now drilling first of eight consecutive wells in proven area. Will sell rig priced right and in addition give balance of eight consecutive contracts on profitable basis. Address reply to Box H-457, The Oil and Gas Journal, Tulsa, Oklahoma.

LEGAL

SEALED BIDS will be received until 2:00 P. M., Mountain Standard Time, October 20, 1954, and opened at that time in the Office of the Fort Peck Indian Agency, Poplar, Montana, for the leasing of 16,714.42 acres of Tribal land and 14,751.68 acres of allotted Indian land, located in Roosevelt and Valley Counties, Montana, for oil and gas mining purposes. The details of the lease offering and how and where to file bids may be obtained by addressing the inquiry to the Superintendent of the Fort Peck Indian Agency, at Poplar, Montana, or telephone, Poplar, 2181.

Statement of the Ownership, Management, Etc., of

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October 11, 1954

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S. H. ROURKE,
Business Manager.

Sworn to and subscribed before me this 28th day of September, 1954.

ROBERT D. FUNK,
Notary Public.

My commission expires April 19, 1955.

EQUIPMENT MEN

Stratoflex Has Opened A Plant At Los Angeles

A. B. QUINN

Construction and opening of a factory branch of Stratoflex, Inc., in Los Angeles, has been announced recently by President Ken W. Davis from Fort Worth headquarters of the organization.

Stratoflex manufactures detachable hose fittings and flexible hose assemblies used on industrial fuel, oil, hydraulic, and pneumatic systems.

The Los Angeles factory has been set up to serve the West Coast, Alaska, and Hawaii. The Los Angeles operation is headed by District Manager A. B. Quinn. W. L. Jones is branch manager and C. L. Parker, plant foreman. Sales engineers for the Los Angeles area are J. J. McGrody and R. G. Wood.

McCullough Opens Sales Office At Denver

McCullough Tool Co. recently opened a new sales office at Denver, Colo. The new office, in charge of J. M. Edwards, geologist and sales engineer, will serve the oil industry in the Denver area.

Edwards joined McCullough Tool Co. in April 1953. Prior to that he had been associated with Union Oil Co. as a geologist. Before his appointment to the new Denver office, Edwards was a logging engineer and geologist working out of main headquarters at Los Angeles.

Thompson Is Lane-Wells Superintendent At Stockton

J. B. Thompson, well-known figure in the oil country, has arrived in Stockton, Calif., to assume responsibilities of station superintendent of Lane-Wells branch, as announced by Ed Saye, district superintendent.

Thompson has been with Lane-Wells Co. since 1947. Prior to his appointment as station superintendent in Stockton, Thompson had been working out of the branch at Russell, Kans., as perforating and logging operator.

Glen Cooper, formerly in charge, goes to Russell to take up his new duties as subdistrict superintendent.

Keating to Head Graver Industrial Waste Group

Robert J. Keating has been made head of the newly formed industrial waste department of Graver Water Conditioning Co. In this position Keating will be in charge of all Graver activity in the rapidly expanding field of waste treatment for industry.

Prior to joining Graver in 1953, Keating spent 7 years in sales and engineering for Orchard Bros., Inc.

Consolidated To Build Pipe Plant Near Provo, Utah

The Consolidated Western Steel Division of United States Steel Corp. has announced it will construct a steel-pipe manufacturing plant near the Geneva Works of U. S. Steel's Columbia-Geneva Steel Division near Provo, Utah.

Alden G. Roach, president of both these divisions said that 117 acres across the street from Geneva Works are being acquired as the site for the new plant and construction will begin early this fall.

Roach said the new plant will give Consolidated Western an integrated production plant situated in the hub of a wide area for demand for such pipe. The plant will produce electric-weld pipe used for transmitting natural gas, petroleum products, and water.

The new Utah mill will have about 5 acres under roof. About 175,000 sq. ft. of this area will encompass the main building which will house equipment for the manufacture of large-diameter expanded line pipe in sizes from 20 to 36 in., and facilities for producing small-diameter, resistant-welded line and water pipe in sizes from 4 to 12¾ in.

Completion of the new Utah plant will give Consolidated Western two modern electric-weld pipe mills for the manufacture of line pipe. The firm's other plant with these facilities in Orange, Tex., will be unaffected by the centralization of far western line pipe operations in one location.

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NATIONAL RAPID MECHANICAL WATER FILTERS

Four 8' x 5' National Rapid Mechanical Water Filters in West Texas.

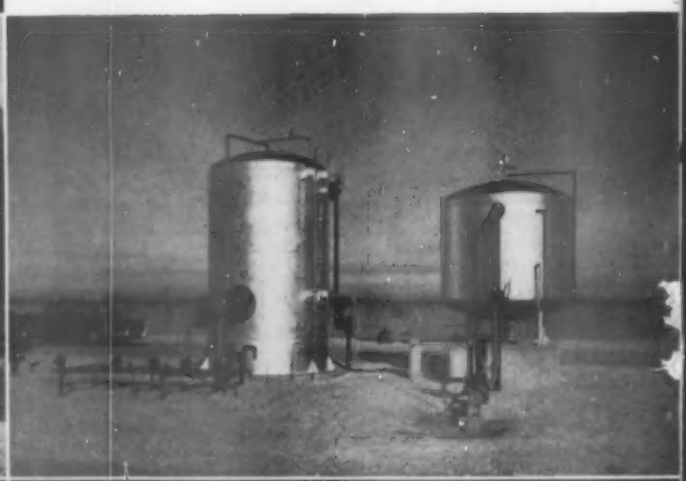
Four 10' x 5' National Rapid Mechanical Water Filters on an Oklahoma water flood project.

National Rapid Mechanical Water Filters are used for filtering water in salt water disposal and water flood projects and municipality installations. Filters are rated according to best empirical values. Common backwash rates are 12 to 20 gallons per minute, per sq. ft. of filter area.

Size	Nominal Water Cap. Bbl./Day	Approximate Weight of 40 lb. W.P.
4' x 5'	1060	1400 lb.
6' x 5'	2300	2100 lb.
7' x 5'	3200	2400 lb.
8' x 5'	4200	3200 lb.
10' x 5'	6600	5540 lb.

NOTE: Filters are furnished in 40, 75 and 100 PSI W.P.

A National 4' x 5' Rapid Mechanical Water Filter in a water disposal plant in Texas.



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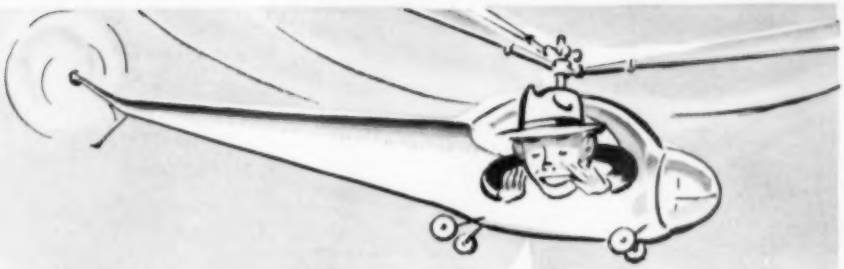
It's a National

NATIONAL TANK COMPANY

TULSA, OKLAHOMA

3-3-53



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